

Rethinking the “theory” in theory of mind development in young children

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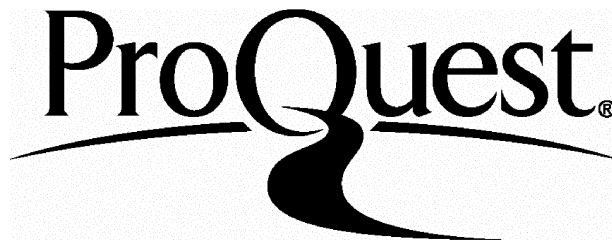
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For Sharyn and Robert

ABSTRACT

This thesis comprises a series of investigations into the development in early childhood of the ability to form mental state attributions, or mentalising. Based on a thorough review of the literature presented in the first chapter, it is concluded that the study of mentalising has lacked a clear a priori methodological approach to the assessment of differential theoretical predictions. Past explanations of mentalising development have, for the most part, attempted to interpret the findings of standard false belief paradigms. Previous theoretical models have therefore chiefly been limited to holistic post hoc explanations of the significance of false belief failure in the early preschool years. Empirical investigations that test a priori theories of mentalising are presently lacking.

The following chapters describe a series of five experiments designed to evaluate the validity of contemporary theories of mentalising. The first two studies aimed to assess whether young children's mentalising performance may be improved by training. The third study used a novel attribution paradigm designed to address, in a more direct fashion, certain mutually exclusive theoretical assumptions and predictions of existing theories. In the fourth and fifth studies, these differential theoretical predictions were examined further by investigating the impact of imagery and pretence on the mentalising performance of young children.

In the final chapter, the results of these studies are discussed in the context of the theoretical perspectives outlined in the introductory chapter. It is concluded that no existing theory of mentalising provides a satisfactory account of the cognitive mechanisms that underlie mentalising development. A conceptual framework which synthesises disparate existing theories of mentalising into a single theory is proposed. It is concluded that this integrated perspective is promising, and deserves to be the object of future research.

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CHAPTER ONE

Literature Review

Theories of Mentalising and Development

1.0 Introduction

Descartes was one of the first philosophers to describe mental phenomena as internal subjective experiences. He considered such states to be products of the brain which are accessible to conscious awareness. Mental phenomena continue to be a focus of spirited debate among philosophers and psychologists. The opaque nature of mental phenomena has rendered them difficult to study empirically, traditionally reducing the topic to a matter of philosophical debate. Recent methodological developments during the past 50 years have, however, liberated this debate from the constraints of philosophy and renewed interest in the study of mind. The past 20 years have seen an explosion of scientific interest in this domain, generating several philosophical and developmental theories that attempt to explain the underlying processes of mental phenomena.

This chapter reviews contemporary theoretical explanations of mental phenomena and provides an overview of current developmental hypotheses pertaining to the acquisition of mental processes throughout early childhood. Throughout this thesis, the term *mental state* will be adopted to include all known inner mental experiences commonly referred to with terms such as *knowing*, *loving*, *believing*, *wishing*, *guessing*, *dreaming*, *wanting*, and *thinking*. Whiten and Perner (1991) identify a crucial distinction between two sub-types in the domain of mental states: attitudes and propositional attitudes. Attitudes, in this sense, refer to the subjective sensations themselves, as first described by Descartes. Knowing, wanting and

dreaming, for example, have associated qualitative “feelings”, yet are distinct from one another. Propositional attitudes are complex attitudes directed toward or about an object or toward or about another proposition. Simple examples of propositional attitudes directed toward objects include knowing the latest gossip or dreaming of a future lover. Other propositional attitudes may be multipropositional, whereby one propositional attitude is embedded within or directed toward a second propositional attitude. A multipropositional attitude may involve, for example, knowing about the latest gossip or dreaming a future lover is a millionaire. Building on these basic distinctions between mental states, Whiten and Perner (1991) described a paradigm in which propositional attitudes may be used to predict and explain the thoughts and behaviours of others. According to this paradigm, there are two individuals: the first is the “mindreader agent”, who attempts to read the thoughts of a second “target agent” individual. What the mindreader seeks to interpret or predict is the target individual’s inner states such as knowing, thinking, believing, and desiring. (Whiten & Perner, 1991). The processes used in mental state attribution for predicting and explaining behaviour, and their development, are the primary focus of this thesis. The general process by which mental state attributions are generated in the domain of social understanding will be referred to as *mentalising*.

1.0.ii Understanding Mental States

Mentalising capabilities are crucial to an everyday understanding of the social world (e.g. Frye & Moore, 1991; Wellman, 1990). It is likely that the natural human ability to successfully negotiate the social world relies on the capacity to acknowledge, interpret and understand that both one’s own mind, and the minds of others, are composed of ever-changing mental states that serve to guide and predict human behaviour. Implicit is the assumption that overt human actions originate from, and are to be comprehended in terms of, underlying mental states. Without such a

fundamental commonsense appreciation of the influence that mental processes exert on behaviour, human social interactions would be rendered nearly impossible to interpret.

1.0.ii.a Mentalising: The Evolutionary Significance

Why have humans developed mentalising abilities? Mitchell (1994) proposed that mentalising abilities are the product of Darwinian natural selection. He argued that an individual possessing cognitive capacities for mentalising would flourish in survival and procreation. For example, effective mentalising would facilitate an individual's success in deception, a skill crucial in battle or hunting. An individual with mentalising abilities would also be better equipped to know what actions might or might not impress or please a potential mate and would therefore be more likely to procreate. Therefore, those individuals with superior mentalising skills would be more likely to survive and to pass on these traits to offspring. Mentalising abilities are also likely to be associated with the evolutionary development of language and the expansion of the frontal cortex (Mitchell, 1994).

1.1 The Development of Mentalising

1.1.i Mentalising: The Developmental Significance

The natural human ability to accurately predict, explain and understand the behaviour of others as a part of everyday social interaction is a tremendous skill, a skill shown to be culturally universal (Avis & Harris, 1991)¹. The acquisition of adultlike mentalising abilities may be considered one of the most significant achievements of early childhood. The investigation of the development of such

¹Note that deficits or delays in mentalising development as a result of a biological deficit may occur in individuals with childhood autism (Baron-Cohen, 1987, 1991). These individuals may show impairments in the social domain including communication, imagination and socialisation (Wing & Gould, 1979; Frith, Happe & Siddons, 1994).

abilities is useful for several reasons. Research into such developmental processes will shed light on the understanding of adultlike mechanisms, of which little is known. Secondly, the possession of these abilities makes an immense difference to the child, for sophisticated mentalising abilities enable the child to make increasing sense of his or her social world and to be an active participant in successful social interactions. Furthermore, adults may become better equipped to understand children, inasmuch as the way adults interact with very young children is often moderated by what we believe a particular child is capable of understanding (Frye & Moore, 1991). For example, adults typically modify speech to accommodate very young children, although further research is necessary to clarify whether this results in any developmental benefits or consequences. Those lacking a full mentalising repertoire may also be at risk of misinterpreting other's actions. For example, specific deficits in mental state understanding may lead to the exhibition of unpopular behaviours with school peers (Denham, McKinly, Couchaud & Holt, 1990). Perhaps most importantly, the study of mentalising throughout development is crucial to the potential development of possible intervention programs to target those identified as at risk because of mentalising or related social deficits.

1.1.ii The Mentalising Debate: Development Ignored

Beginning with the writings of Descartes, the study of human mentalising abilities has traditionally been confined to the examination of adult mentalising processes. It was not until the emergence of developmental psychology as a scientific tradition through the groundbreaking work of Jean Piaget in the 1930s that the development of mentalising processes was thoroughly investigated empirically. Through a series of novel empirical studies and the naturalistic observations of his own children, Piaget posited a stagelike theory of the development of mentalising dubbed the "childhood egocentrism theory". Piaget maintained that, during

maturation, young children pass through various stages of mentalising which differ significantly from those of the adult thinker. According to this theory, it is not until around the ages of 6 or 7 years that children demonstrate “decentring” capabilities, defined as the ability to acknowledge that one’s perspective of a situation is only one of many potential viewpoints and to organise these potential viewpoints into a coherent system. Piaget and Inhelder (1956) devised the now-famous “three mountains” task to test this view. In this task, a doll protagonist is placed at various locations around a three-dimensional mountain scene. It is the child’s task to select from a variety of “views” depicted in snapshots of the visual perspective of the doll at specific localities around the mountain scene. Piaget and Inhelder (1956) found that it was not until about the age of 6 or 7 that young children succeeded at this task. Piaget concluded that young children are unable to imagine a visual perspective different from their own and are thus primarily egocentric thinkers until later childhood (Piaget & Inhelder, 1956).

Piaget had a profound impact on the way in which children’s mentalising has been tested and explained. Piaget’s work was so advanced that his proposals endured for many years. Through the 1960s and early 1970s, developmental research in the field was relatively sparse, and Piaget’s theory remained dominant. Eventually, however, Piaget’s methodology was called into question, although it was not until the 1970s that evidence which refuted many of Piaget’s conclusions on methodological grounds began to mount (e.g. Donaldson, Donaldson & Harris, 1978; Flavell, Everett, Croft & Flavell, 1981; Hughes & Donaldson, 1979).

Because of the limited linguistic and other cognitive capabilities of very young children, for many years there remained no methodologically sound empirical paradigm for investigating the mentalising abilities of young children (Carruthers & Smith, 1996). Moreover, the opaque nature of mental states themselves provided

many empirical difficulties for investigators. Finally, a lack of activity in other traditions such as philosophy, primatology and cognitive psychology probably contributed to the lack of scientific enquiry into the developmental processes of mentalising (Carruthers & Smith, 1996).

1.1.ii.a From Primates to Children

Philosophical discussions concerning the human capacity for mentalising as a function of everyday social interaction and communication have led primatologists to question whether it is a trait unique to the human species² (e.g. Carruthers & Smith, 1996; Davies & Stone, 1995; Moore & Frye, 1991; Povinelli, 1996; Wellman, 1990; Whiten & Perner, 1991). Premack and Woodruff's (1978) now classic investigation attempting to assess a chimpanzee's ability to use and predict the actions of a goal-directed individual was influential in renewing scientific interest into the development of mentalising in humans. Premack and Woodruff's (1978) nonverbal experimental paradigm for testing these abilities in primates had instant appeal to developmentalists, who had previously lacked an empirical test suitable for the early language abilities of children. Furthermore, interest arose in attempting to identify whether primates and children show similar trends in mental state understanding. Perhaps the greatest impact of Premack and Woodruff's (1978) investigation on the study of present-day theories of mentalising was the modern Cartesian proposal that such concepts operate within a theorylike logical framework. Premack and Woodruff (1978) referred to such processes as a *theory of mind*:

“In saying that an individual has a theory of mind, we mean that the individual imputes mental states to himself and others (either to conspecifics or to other species

²Note that this debate is currently ongoing and has yet to be resolved. It is not, however, within the scope of this thesis to develop the relevant issues. See Carruthers and Smith (1996), Chapters 17-20, for recent discussions.

as well). A system of inferences of this kind is properly viewed as a theory, first, because such states are not directly observable, and second, because the system can be used to make predictions, specifically about the behaviour of other organisms...” (Premack & Woodruff, 1978, p515).

In the years following this landmark publication, there has been a surge of research into the theory of mind hypothesis. Premack and Woodruff’s theory of mind hypothesis has enjoyed considerable success and has sparked a great deal of research into the understanding of mind, particularly in the realm of developmental psychology³.

1.1.iii The Development of False Belief Understanding

Influenced by early discussions of the methodological issues surrounding the assessment of primate-behaviour-prediction abilities, Wimmer and Perner (1983) devised a now-classic paradigm to assess such abilities in young children, the “unexpected transfer Maxi false belief task”. The task was aimed specifically at measuring the young child’s ability to accurately predict another’s action based on the other’s belief, in contrast to what is known to be true by the child (Wimmer & Perner, 1983). Thus, the child must predict a protagonist’s futile search for a displaced object as a function of his outdated or *false belief* about the location of the object. In this

³The term *theory of mind* is often used in the cognitive and developmental literature to describe the deployment or possession of specific mentalising abilities, usually in reference to competence at an adult level, and is sometimes applied in reference to other sociocognitive processes. It is argued here, however, that the phrase theory of mind makes the assumption that the process or mechanism of mentalising is truly underpinned by a “theory”. While theorylike explanations of mentalising have been put forward, there is currently considerable theoretical dispute as to whether the relevant principles are in fact operated by an underlying theoretical system. A predominate focus of this thesis is to further explore and evaluate the various theories of mentalising. To use the phrase throughout this discussion, it is argued, is to confuse major theoretical issues pertaining to the development of mentalising and to presuppose the “theory” of theory of mind exists. Thus, against popular convention, for the purposes of this discussion the term will be replaced by mentalising.

task, the protagonist, a boy doll named Maxi, comes to hold a mistaken belief about the location of his chocolate because, in his absence, his mother moved it to a second location. It is the child's task to predict how Maxi's mistaken belief would influence his search for the object. The now well replicated finding using this type of paradigm shows that it is not until around the fourth or fifth year of life that young children successfully predict that a false belief about the location of the chocolate will result in a mistaken search for it. The correct response requires the child to predict that, in disservice to his immediate goal of obtaining the chocolate, Maxi will incorrectly search in its initial, but now empty location because of a false belief about its location (Gopnik & Slaughter, 1991; Gopnik, Meltzoff & Slaughter, 1994; Moses, 1993; Wellman & Banerjee, 1991; Wimmer & Perner, 1983).

The developmental increase in the ability to attribute false beliefs to others from ages 3 to 5 years has come to be known by many as the hallmark of full-blown adultlike mentalising capacities and has been the interest of a great deal of research. Success on the false belief task appears to define a crucial stage in the development of mentalising abilities, as the child is equipped to understand in a sophisticated manner how beliefs as mental entities come to influence behaviour (Davies & Stone, 1995). As a result, false belief understanding has become a type of mentalising "litmus test" (Charman, 2000) and is currently used widely to assess children's abilities in this realm.

Perner, Leekam and Wimmer (1987, *Study 2*) expanded the false belief paradigm by devising a second procedure for assessing mentalising ability, the "deceptive box 'Smarties' false belief task". The child was given direct experience of holding a false belief before the administration of the test question in an attempt to highlight how people may be misled. In this task, children are asked to recall their earlier false belief about the contents of a deceptive box. The children are introduced

to a familiar sweet container, a Smarties tube, and asked to declare what they think is inside the tube (all respond correctly with “Smarties” or “sweets”). The tube is opened to reveal unexpected contents: pencils. The tube is subsequently closed, and the child is asked to recall his or her earlier false belief about the contents of the tube. Next, a friend (unaware of the true contents of the box) is introduced, and the child is asked to predict the friend’s belief concerning the contents of the box. The initial literature revealed some discrepancy in the difficulty of “self” and “other” attributions but the now well replicated finding on this task follows that of the Wimmer & Perner’s (1983) Maxi task. As before, 4-year-olds are able to recall their original belief about the contents of the box and correctly predict another’s false belief but 3-year-olds consistently indicate that they had initially thought the pencils were in the box and similarly that the friend will initially think the box contains pencils (e.g. Gopnik & Astington, 1988; Wimmer & Hartl, 1991).

Before the advent of false belief tasks to assess young children’s mentalising abilities in the 1980s, the measurement of young children’s cognitive capacities typically involved more qualitative, naturalistic techniques of assessment. In recent years, this type of sociodevelopmental approach has been overshadowed by a surge of research coming from laboratories using experimental designs. The evidence collected from qualitative sociodevelopmental research is not to be undervalued, for such research has produced useful insights into young children’s cognitive development. Sociodevelopmental research favours the investigation and measurement of how, in the context of natural socialisation, experiences may influence and reveal young children’s mentalising abilities (Dunn, 1995). Young children’s early spontaneous communicative gestures, such as gaze following and pointing, and, later on, instances of teasing, joking, comforting and deception are often cited as evidence that young children have considerable insights into mental

phenomena (Bretherton, 1991; Bretherton, McNew & Beeghley-Smith, 1981; Dunn, 1996; Reddy, 1991). From this point of view, it is argued that successful teasing or joking, for example, entail a fairly sophisticated understanding of underlying mental states in the appreciation of what will annoy or amuse the other person. These researchers maintain that mentalising abilities remain implicit in behaviour during the preverbal time and are embedded in pointing and other communicative gestures. It is not until the mastery of language that mentalising becomes explicit, observable and more assessable to research.

1.1.iv Mentalising Before False Belief Success

While successful false belief understanding around the fourth birthday has become a hallmark of true mentalising abilities, from birth young children acquire and exhibit competence in various potential “prerequisite” skills for full-blown mentalising. The sophistication of early skills in social understanding during this period should not be underestimated, for the achievements are great. The sections to follow will provide a brief overview of these abilities through the preschool years. Although these sections are designed to provide a general overview of pre-false belief mentalising abilities, it is acknowledged that there is considerable dispute within the field about how these early behaviours should be interpreted. It is not the intention in these sections to attempt to interpret what the exhibition of certain behaviours may mean about what children actually understand about other people. In the sections to follow, some of the developmental progressions of mentalising will be charted to help clarify young children’s early competencies.

1.1.iv.a Mentalising During Infancy

Increasing amounts of research into the unfolding of prerequisite skills for later mentalising capabilities in infancy show that, from the very beginning, infants are equipped to learn about people (Flavell, 1999). Amongst the earliest social skills

demonstrated by infants is in the realm of motor imitation. For example, by 12 days of age, infants successfully imitate adult facial expressions (Meltzoff & Moore, 1977). Even neonates as young as 42 minutes of age have been shown to imitate adult movements such as tongue or lip protrusions and mouth openings (Meltzoff & Moore, 1983). Older infants appear to selectively imitate movements in humans also, but this does not generalise to objects, potentially suggesting an early underlying attention to, or understanding of, human agency (Flavell, Miller & Miller, 1993). One of the earliest overt signs pointing to the exploitation of mentalising for the purposes of social communication appears at about one month of age when infants engage the attention of another through mutual gaze contact (Cox, 1981). Throughout the first year of life, young children, in their display of frustration and surprise, appear to demonstrate that they hold and experience their own beliefs and desires (Astington & Gopnik, 1990). By the end of the first year, children understand how people differ from objects and begin to discern how people relate to objects (Flavell, 1999). Children also learn more sophisticated strategies of using mental states to influence the behaviour of others. Showing and pointing behaviours begin to emerge, whereby the attention of others is directed to some aspect of the world they share (Cox, 1981). By the end of the first year, children expect that an adult will reach for an object toward which they have directed positive affect, potentially demonstrating at least some understanding that human behaviour is goal-directed (Spelke, Philips & Woodward, 1995).

1.1.iv.b Mentalising at 18 Months to 3 Years of Age

At the age of about 18 months there is a substantive developmental change in children's symbolic capabilities with the emergence of pretence and language,

particularly mental state talk (Bretherton, 1991)⁴. Infants appear to develop the ability to learn object names by observing the adult's attentional focus and attending to the label assigned to it by the adult without interference from irrelevant perceptually salient objects (Baldwin & Moses, 1994). Children increasingly demonstrate an explicit understanding of mental states, as they become proficient users of language. On the basis of maternal reports and direct observations, Bretherton, (Bretherton, McNew & Beeghley-Smith, 1981; Bretherton & Beeghley, 1982) found that, by 20 months of age, 30 percent of children sampled were referencing internal states, such as pain and hunger, and mental states, such as knowing and believing, in their everyday social communication. By 28 months, most children were making such references to mental states, albeit rarely, and the frequency of such utterances increased rapidly during the third year of life (Bretherton & Beeghley, 1982; Dunn, 1988; Dunn, Bretherton & Munn, 1987; Shatz, Wellman & Silber, 1983).

Moreover, by 18 to 24 months, children begin to show some basic understanding of the principles of visual perception. By 2 years of age, children will correctly indicate that, in order to see an object, an individual must have their eyes open and oriented at an object with no obstruction in their line of sight (Flavell, 1992). Children of this age also demonstrate simple, nonegocentric perspective-taking skills. For example, when a two-sided card is held between an experimenter and the child, a 2-year-old will correctly indicate that he or she and the experimenter currently see different pictures (Flavell et al., 1981).

By the third year, children correctly judge actions and emotional reactions pertaining to goal-directed behaviour, e.g. that people will continue to search if a

⁴Although children may engage in acts of pretend play and make references to mental states in their spontaneous speech, there is some debate as to whether very young children fully understand these concepts. These issues will be more fully developed in later chapters.

sought-after object is not found, or that they will be sad if they do not find it and happy if they do (Wellman & Woolley, 1990). By 3 years of age children have mastered the boundaries between the pretend or fantasy world and the real world (Harris, Brown, Marriott, Whittal & Harmer, 1991; Johnson & Harris, 1994; Wellman & Estes, 1986). Three-year-olds understand and correctly identify the properties of pretend versus real objects. For example, by this age children know that a pretend biscuit cannot be seen, eaten or touched and can correctly judge that a fairy may be responsible for magic events while a boy may be responsible for real events (Johnson & Harris, 1994; Wellman & Estes, 1986). Moreover, 3-year-olds do not attribute physical properties to mental images (Estes, Wellman & Woolley, 1989). Three-year-olds are also adept at remembering their earlier desires, intentions and pretences. At this age, children also begin to understand intended and unintended action (Shultz, 1980). Three-year-olds have a firm understanding of desires. In addition, they successfully predict someone's action based on their belief, so long as it does not conflict with their own beliefs (Astington & Gopnik, 1991a).

1.1.iv.c Mentalising and Language: A Possible Developmental Link

There is increasing evidence to suggest that early developments in social communication, such as mental state talk and social pretend play, may be linked to the development of mentalising abilities. For example, success on certain tasks of belief has been found to correlate with specific standard language measures, (e.g. Astington & Jenkins, 1995; Fonagy, Redfern & Charman, 1996; Jenkins & Astington, 1996). Similarly, a relationship has been shown between the comprehension of mental state terms such as *think* and *know* and success on false belief tasks (Moore, Pure & Furrow, 1990). Furthermore, when linguistic demands are lowered in standard tasks of false belief, performance may be bolstered (Clements & Perner, 1994; Lewis & Osborne, 1990; Sullivan & Winner, 1991). The findings of some studies also indicate

that exposure to social situations may facilitate the development of mentalising abilities. For example, several studies have shown those children in large or extended families have superior false belief understanding (Jenkins & Astington, 1996; Lewis, Freeman, Kyriakidou & Maridaki-Kassotaki, 1996; Perner, Ruffman & Leekam, 1994; Ruffman, Perner, Naito, Parkin & Clements, 1996). It has been demonstrated that children who engage in more instances of spontaneous pretend play are likely to demonstrate earlier success on false belief tasks (Jenkins, 1995; Youngblade & Dunn, 1995). In a study investigating the interaction between the frequency of mental state talk within pretend-play episodes, Hughes and Dunn (1997) found that a preschool sample of children was significantly more likely to make reference to mental states during pretend than nonpretend play activities. Furthermore, children were significantly more likely to use mental state expressions to direct the activity and to refer to a companion's mental state during pretend play than during nonpretend play (Hughes & Dunn, 1997). In another naturalistic longitudinal study of spontaneous language, Dunn, Brown, Slomkowski, Tesla and Youngblade (1991) found that the frequency of spontaneous feeling state talk during disputes in a sample of children aged 2 years, 9 months predicted false belief success seven months later. Astington and Jenkins (1995) also conducted a thorough longitudinal investigation into the impact of language development on mentalising capabilities. In this study, the language and mentalising abilities of 3-year-old children were charted over a three-month period. Evidence was found to support the notion that language ability at the time of the original assessment predicted false belief performance three months later, but not the reverse. These findings have been regarded as evidence supporting the Vygotskian idea that mentalising development may be mediated by talk and interaction within the child's social world: children with greater language skills, who are better able to participate in linguistic interaction, will benefit more from such

interactions (Jenkins & Astington, 1996). Further research is necessary to clarify the causal direction and the possible interaction between mentalising and language development.

1.2 Theories of Mentalising

1.2.i The Theory Theory

Since the fall of behaviourism in the late 1960s, philosophical discussions of adult human mentalising have been dominated by various versions of the so-called *theory theory*. The principal assertion of the theory theory is that the conscious understanding of mentalising is underpinned by functional folk-psychological theory. Folk-psychology, like folk-physics, is an implicitly held body of commonsense or “layperson” knowledge.

According to the theory theory, the understanding of mentalising and the ability to deploy mental attributions are based on an internally represented folk-psychological theoretical framework depicting the structure and function of the human mind (e.g. Carruthers, 1996; Fodor 1987; Gopnik & Meltzoff, 1997; Perner, 1991; Wellman, 1990). According to this hypothesis, the processes of mental state attribution underlying the explanation and prediction of human behaviour are governed by an internally represented set of laws and rules of that domain, which form a theoretical “knowledge structure” (Stich & Nichols, 1992). By this account, knowledge about the mind and mentalising capabilities are grounded in an everyday base theory, which embodies a system of interdependent concepts, specifies domain-specific processes, and operates through the exploitation of causal principles (Flavell, 1999). Proponents of the theory theory maintain that folk-psychology is a collection of many interrelated theories, which together form a more general theory by which the mind and behaviour is understood.

Supporters of the theory theory have proposed structural, functional and featural parallels between the conceptual status of scientific theory and commonsense folk-psychological theory, in a bid to show that folk-psychology is, in fact, a theory (Botterill, 1996; Gopnik & Meltzoff, 1997). It is argued that folk-psychological theories serve the functions of scientific theories: explanation, prediction and interpretation (Botterill, 1996; Gopnik & Meltzoff, 1997). For example, Newton's law of gravity predicts and explains how objects are drawn together by force; in folk-psychological theory, action is predicted based on how belief, desire, and intention interrelate. Mental states, according to this view, operate under a system of coherence whereby each component mental state does not operate in isolation, but rather is grounded in a series of related components. In scientific theory, for example, atoms form molecules; molecules, in turn, form cells, which in turn make up living creatures. Similarly, it is proposed that to understand one type of mental state is to understand how it relates to other propositional attitudes (Carruthers, 1996). For example, to understand *wishing* is to understand *desiring* and *believing* (i.e. the act of wishing will fulfil the desired wish). Ontologically, folk-psychological theory permits the adult thinker to distinguish between the mental world on one hand and the physical world on the other (Wellman, 1990).

It is also argued that folk-psychology fulfils the basic structural components of scientific theory: abstractness, causality, coherence and ontological commitment (Gopnik & Meltzoff, 1997; Wellman, 1990). On this account, mental states are abstract in that they are invisible, analogous to electron particles or calories identified in scientific theory. According to this view, folk-psychological theory follows scientific theory in the appeal for causality; such theories, like scientific theories, work to identify and pinpoint structures that cause consistencies in observed data. Mental state attribution is postulated to entail the deployment of one's own theoretical

knowledge about perceptual access, attention, background knowledge, and beliefs as well as how beliefs, desires, and intentions interact to influence behaviour and interpretations of another's behaviour. Such knowledge is hypothesised to be interconnected and to form a coherent theoretical system of mentalising. The concepts are said to be organised in lawlike structures, which are formulated according to definite theoretical rules. Such rules operate according to logical principles, which may, for example, be formulated as,

“That someone who wants it to be the case that Q, and believes that if P then Q, and believes that P is within their power, will, other things being equal, form an intention to cause it to be the case that P; that someone who has formed an intention to bring it about that P when R, and who believes that R, will then act so as to bring it about that P; that someone who believes that all Fs and Gs, and who comes to believe that F-of-a, will also believe G-of-a; and so on” (Carruthers, 1996, p24).

From the theory theory perspective, an individual's theory of folk-psychology is a mechanism that distributes representations to input just as the individual's perceptual systems assign representations to visual or phonological input (Gopnik & Meltzoff, 1997). That is, the putative theorising system encodes perceptual and syntactical input, passed on from sensory systems, into representations for further processing. The representations, in turn, interact with, and are formulated by, lawlike rules that result in a higher level representation of the material and provide the material for folk-psychological theorising.

1.2.i.a Objections to the Theory Theory

The main criticism launched against the theory theory of mentalising is its lack of parsimony. Heal (1996), for example, argued that the folk-psychological theoretical system of just one person would be one that would include such a vast amount of information that, if transcribed, would fill many volumes. Heal (1996) questioned how such a system is equipped to select relevant information, enabling the formulation of an adequate mental state attribution to another whose folk-

psychological system would differ substantially: if all information is linked, how is it possible to ever rule out the possibility of irrelevance of input? Theory theorists have, thus far, been unable to articulate a full syntax of how a theory of folk-psychological principles may function. The “frame problem” encountered by artificial intelligence researchers demonstrates the difficulty in generating a set of rules that successfully negotiate the relevance of data presented to the system. Furthermore, it is unlikely that, from the vast number of logical possibilities generated by the proposed rule-governed theorising system, an accurate or reliable folk-psychological solution will prevail. The inability of theory theorists to articulate the proposed theory fully is considered to be a fundamental weakness of this position.

Similarly, Goldman (1989) expressed doubts about the ability of the proposed theoretical system to sift through available information in order to generate an appropriate and useful response attribution, citing a study by Kahneman and Tversky (1982) as supportive evidence. Subjects in this study were presented with a scenario in which two characters, Protagonist 1 and Protagonist 2, who were to board separate flights scheduled to leave at the same time. The two men were caught in traffic and arrived 30 minutes past the departures of their respective flights. Protagonist 1 is informed that his flight left on time, as scheduled, but Protagonist 2 is told that his flight was delayed and that it left only five minutes before his late arrival to the airport. Kahneman and Tversky (1982) found that 96 percent of their sample reported that Protagonist 2 would be more upset than Protagonist 1. Goldman (1989) argued that it is unlikely that subjects in this study held any sort of tacit theory of this situation to access in responding; rather, the subjects merely imagined how they *themselves* would feel in this situation and responded accordingly.

In a similar vein, Goldman (1989) argued that people’s intuitive grasp of humour is unlikely to be based on any theory about “what amuses people” but instead

entails a simple projection of one's own reaction to a joke onto the other, in order to predict whether it will be found humorous. Thus, a theory of relevance would be put to the test in the case of humour, for taste in humour varies vastly from individual to individual. Furthermore, the non-literal format of humour is likely to pose great difficulties in activating the appropriate knowledge base to enable an accurate judgement.

1.2.ii Theory Theory Developmental Perspectives

1.2.ii.a Theory Theory Rationalism

Various proponents of the theory theory view have put forward differing accounts of how the mechanism by which the proposed theoretical system of mentalising operates. The rationalist or modular view of the theory theory is that intentional folk-psychology is formed by a database of innate, domain-specific mechanisms of the mind called *modules* (Fodor, 1983, 1987). Modular accounts of mentalising suggest that there is a specific module or component in the brain that is responsible for competence in the domain of mentalising:

“Once we have reason to believe that there exists a genuine competence with a definite domain of application, we can ask for an explanation of the competence. To put it crudely: where there is something definite that we can do, we can ask if there is something definite within us that enables us to do it” (Segal, 1996, p142).

In the rationalist view of the theory theory, explicit theoretical folk-psychological principles are determined by the maturation of innate modules⁵ (Fodor, 1987, 1992). By this view, folk-psychological understanding is governed by

⁵Note that Fodor's (1992) modularity view of mentalising is not to be confused with Leslie's (1994b) modularity hypothesis. Although similar in some respects, the two views differ crucially in their proposed underlying mentalising mechanism. While Fodor postulates from a theory theorist perspective, Leslie (e.g. 1992, 1994) does not advocate the notion that a theorylike mechanism is primarily responsible for mentalising capabilities. See Sections 1.2.v.b -1.2.v.c for further discussion.

specialised innate mechanisms that link a lawlike structure of representational systems to rules of a higher syntactic system. The modular theory account of development proposes that folk-psychological concepts are acquired through the maturation of specific modules which govern a system of representations and representational input (Fodor, 1987). The modules organise perceptual input into a series of abstract representations, and this output is then taken up by other theoretical systems for processing. Fodor (1992) argued that the folk-psychological competence of young children does not differ from that of adults; however, the constraints of an immature modular system limit the ability of children to exploit computational resources needed to access the theory of mentalising. According to this view, therefore, maturation of these specialised modular structures determines the development of folk-psychological understanding. Regardless of how much experience and evidence are acquired through development, the immature theories governed by the modules may not be re-modified until maturation (Fodor, 1983, 1987). Experience, then, may not influence or reshape early theories; instead, developmental changes are products of changes outside the representational system. It is the maturation of various nonmentalising modules that trigger the mentalising module to come on-line. Modular theory accounts of mentalising have recently enjoyed considerable success in explaining other representational processes, including Marr's (1982) modular account of perceptual systems and Chomsky's (1980) universal grammar account of language. According to the theory theory modularity hypothesis, folk-psychological understanding is successful in attributing accurate predictions and explanations of mental states because it is specially designed for this purpose. Modular accounts of the theory theory distinguish between modules designed for handling peripheral low-level knowledge and those employed in "central process" knowledge, including scientific and folk-psychological knowledge (Fodor,

1983; Karmiloff-Smith, 1992). Karmiloff-Smith's (1992) modular account maintains modules may be overturned and revised through information from the peripheral systems being made available to central theorising systems, a process she calls "representational redescription".

1.2.ii.c Theory Theory Child-as-Scientist Hypothesis

In contrast to the modular theory theory account, a second view proposes that young children play a more active role in their mentalising development. Gopnik (e.g. Astington & Gopnik, 1991a; Gopnik & Meltzoff, 1997; Gopnik & Wellman, 1992; Meltzoff & Gopnik, 1993) has provided the most thorough account of the "child-as-scientist hypothesis" of folk-psychological development. According to this view, folk-psychological theory emerges from an innate set of representations of input, which are controlled by the rules of the theoretical knowledge base. The central tenet of this view is that the development of folk-psychological theory (and other domains of cognitive development) is analogous to the development of the cognitive processes exploited in adult scientific reasoning (Gopnik & Meltzoff, 1997). That is, the processes of cognitive development in childhood are hypothesised to parallel the evolution of authentically novel and abstract representations of worldviews through the experience of scientific theory change. Gopnik and Meltzoff (1997) propose that the structured scientific enterprise of explanation, prediction, casual attribution, theory formation and testing is the culturally organised exploitation of natural processes for conceptual change. Accordingly, it is these processes that provide the ability to advance conceptual changes in cognitive development in childhood:

"Science uses a set of representations and rules particularly well suited to uncovering facts about the world. Science gets it right because it uses psychological devices designed by evolution to get things right" (Gopnik & Meltzoff, 1997, p17).

Structurally, cognitive developmental theories are said to parallel scientific theories in ontological commitment, appeal for causality, coherence and abstractness (Gopnik & Meltzoff, 1997; Flavell, 1999). By this view, both cognitive developmental and scientific theories are constructed with respect to assimilated evidence, and at any time may be overturned by the presentation of sufficient evidence for theory remodification (Gopnik & Meltzoff, 1997). With the accumulation of enough counter-evidence, early theories are eventually replaced with alternative models, which in turn face a period of testing until more firmly developed.

According to the child-as-scientist hypothesis, the development of a genuine understanding of the mind entails a stagelike progression of theory remodification of folk-psychological principles (Gopnik & Meltzoff, 1997; Gopnik, Meltzoff & Slaughter, 1994). This rapid concept acquisition and generalisation results in a radical conceptual shift in mentalising around the fourth birthday (Gopnik & Astington, 1988; Gopnik & Slaughter, 1990; Perner, 1988, 1991; Wimmer & Hartl, 1991). As children develop a theory of mentalising they construct “layperson theories” about the world, which, in turn, regulate their perception and understanding of the world around them. Therefore, as a child has new experiences and gains new information, he or she modifies and adapts his or her existing theories about the world to override the less formal theories, replacing them with new and more accurate ones. Social experience for the child may be considered much like the painstaking data collection of the scientist. The new “data” or experience is incorporated within and compared with existing theories until sufficient information is accumulated to override the old theories and to confirm new ones.

Contrary to the modular theory theory account, the child-as-scientist perspective advocates an active process of folk-psychology acquisition. By this view, children are endowed throughout development with a basic defeasible theoretical

mechanism that is continuously modified until a formal adultlike theory of folk-psychology is acquired. The patterns of representation may modify the core representational system as new inputs are incorporated and new representational connections are formed (Gopnik & Meltzoff, 1997). By this view, the representational system will develop in a predictable and constrained way with the innate ability for early theory reformation enabling all children to generate the same adultlike version of folk-psychology around the same time:

“The theory theory proposes that there are mechanisms that, given evidence, alter representation in particular ways. If two children start out with the same theory and are given the same pattern of evidence they will converge on the same theory at roughly the same time” (Gopnik & Meltzoff, 1997, p53).

Gopnik et al. (1994) propose that throughout mentalising development there exist some “precursor” stages of mental state understanding: fundamental base structures that may serve as models for later mentalising competencies. Similarly, Flavell (1988) has proposed a “cognitive connections theory”, maintaining that, by the age of 2 to 3 years, children appreciate that people may be mentally related to things in the outer world in a variety of ways. This understanding, however, is limited to a superficial and primitive understanding, which Flavell defined as involving “Level-1” visual-perspective-taking capacities, or the simple appreciation that objects can or cannot be seen from another’s visual perspective. It is not until the age of 4 that children have acquired “Level-2” concepts and are able to acknowledge that someone may see, and therefore interpret, things differently (Flavell et al., 1981). Wellman (1990, Bartsch & Wellman, 1995) has identified a stagelike progression to belief-desire reasoning. At 2 years of age, children have a basic understanding of the principle of desire and the related emotional outcomes associated with fulfilment or nonfulfilment of a particular desire (Wellman, 1990). At this stage, however, desire understanding is said to be nonrepresentational. Children understand how people are

connected to things by experiencing wants, fears, etc., but do not acknowledge that individuals may be influenced by the way in which they represent these things (i.e. accurately or inaccurately) (Flavell, 1999). By this account, children develop around the age of 3 a more in-depth understanding of desires, acknowledging that they can differ from person to person, that they are represented internally and can be true *or* false. It is hypothesised that at this stage, children continue to explain their beliefs and the beliefs of others purely in terms of desires (Wellman, 1990). It is proposed that children at about the age of 4 have a sophisticated understanding of how actions are formed as a consequence of their beliefs and desires; this understanding is referred to as a *belief-desire psychology*.

Support for the theory reformation view comes from studies reporting the timing of onset of various mentalising abilities. The understanding of the principles of full-blown mentalising such as complex belief attributions, Level-2 visual perspective taking and real-apparent distinctions are, for the most part, acquired simultaneously sometime during the fourth or fifth year of life. This apparently simultaneous onset of concepts is taken as evidence for a formal theory remodification of mentalising principles at this age (Astington & Gopnik, 1991a).

Proponents of the child-as-scientist hypothesis propose that the understanding of mentalising exists as an “intuitive theory” (Slaughter & Gopnik, 1996). That is, mentalising incorporates a set of domain-specific concepts, with the acquisition of new knowledge regarding a concept inside the domain potentially influencing the other concepts as a function of the degree to which they are interrelated. Contrary to the modular theory hypothesis, the child-as-scientist approach posits an intuitive theory that is grounded in the concept of “conceptual coherence”, whereby the understanding of various concepts within the realm of mentalising operate not in isolation but rather as an interrelated network (Slaughter & Gopnik, 1996; Wellman,

1998, 1990). Evidence taken in support for this notion comes from various empirical investigations showing that when specific interrelated components of a protagonist's mentalising, such as his or her desire, intention, perception and emotional reaction, are highlighted in a task of belief, children's task performance is shown to be significantly enhanced (Gopnik et al., 1994; Moses, 1993; Wellman & Banerjee, 1991). It is argued such findings may show that children's mentalising is a compilation of an intuitive theory network, as when the relatedness of the various mental components are made more salient to young children, they demonstrate greater understanding of the concepts.

1.2.iii The Simulation Theory

Working independently, Heal (1986) and Gordon (1986) were the first to refute the idea that mentalising relies primarily on a formal body of knowledge organised into a theoretical structure. In their view, dubbed the *mental simulation theory*, mental attributions are generated by the exploitation of one's own mental resources coupled with a capacity for off-line practical reasoning (Gordon, 1986, 1996; Heal 1986, 1996). The simulation perspective proposes that, when predicting or explaining the behaviour or mental state of another, individuals attempt to "replicate" (Heal, 1986) or "simulate" (Goldman, 1989, 1992, 1995; Gordon, 1986, 1995, 1996; Harris, 1989, 1992) the target agent's current mental state. Through this simulation, an attempt is made to imaginatively identify the initial mental states of the target agent, in order to choose a course of action using the processes of the simulator agent's own decision-making system. It is this imaginatively construed off-line simulated decision that is subsequently attributed to the other.

According to the simulation hypothesis, the simulator agent implicitly supplies his or her executive decision-maker with simulated pretend beliefs and desires. He or she then tacitly executes the standard processes of his or her decision-maker in an off-

line manner, and formulates a decision of what he or she is to do, based on the pretend inputs of the simulation process. The corresponding decision is taken off-line (i.e. as not to be acted on) and the solution is attributed to the target agent (Goldman, 1989, 1995; Gordon, 1986, 1995). The input fed into the decision-maker during the off-line simulation is considered a type of “pretend play”, whereby the simulator agent imagines and attempts projective identification with the circumstances of the target agent. The simulator agent then decides what to do under the feigned circumstances and attributes this solution-decision to the target agent (Gordon, 1986, 1995). In other words, in ascribing mental states to others, one imaginatively pretends to be in the other’s place. One arrives at the mental state attribution by “pretending” to formulate a decision of what one would do *being* in the other’s shoes, while simultaneously attempting to accurately take into account the target’s current perceptual reality. In order to simulate another, it is crucial for the simulator agent to feed the decision-maker with “pretend” inputs that accurately represent the perspective of the target agent. Failure to do so is likely to result in the decision-maker producing an unreliable and inaccurate output (Harris, 1992). In attempting to identify the cause of another person’s behaviour, the simulator agent tries to “adjust the facts”, such as temporal and spatial location, by searching the environment for clues through processes such as facial mimicry and gaze following. (Gordon, 1986, 1995),

“As in the case of hypothetical self-prediction, the methodology essentially involves *deciding what to do*; but, extended to people of ‘minds’ different from one’s own, this is not the same as deciding *what I myself would do*. One tries to make adjustments *for relevant differences*. In chess, for example, a player would make not only the imaginative shifts required for prediction ‘what *I* would do in his shoes’, but the further shifts required for the predicting what *he* will do in his shoes” (Gordon, 1995, p63).

Gordon (1986, 1995) argued that self-attribution is reliable because a solution is implicitly generated at a level of action *before* formulation of the attribution. That is, the decision regarding “what to do” has already been arrived at for the attribution:

“The trick, of course, is to not predict until ‘one has made up one’s own mind’ what to do: then one simply declares what one ‘intends’ to do” (Gordon, 1995, p61).

It is this process of self-prediction that Gordon (1986, 1995) argued is employed for mentalising. According to this view, individuals bypass any sort of logical or theoretical reasoning about folk-psychology. Rather, it is proposed that mental states are generated by reasoning practically about what action is to be taken within the context of a simulated perspective. During the process of mental simulation, theoretical knowledge may be exploited, although this occurs to a limited extent and the attribution does not depend on any sort of formulation of a “theory” of relevance to apply to the situation (Goldman, 1989, 1985).

It has been argued that simulation theory is appealing from the standpoints of both parsimony and evolution, since it proposes that psychological mechanisms used for problem solving and decision making are exploited for another purpose (i.e. mentalising) (Nichols, Stich, Leslie & Klein, 1996). By this account, the processes exploited in the simulation process (e.g. decision-making processes) have been selectively modified through natural selection, similar to documented cases from biology in which a mechanism initially used for one function in an animal is exploited functionally for another purpose (Nichols et al., 1996).

1.2.iii.a Simulation and Introspective Awareness

While simulation theorists generally agree on the central tenets of the theory, such as the processes of imaginative identification and off-line reasoning, they disagree on the potential role of introspective awareness in the simulation process. Harris (1989, 1992, 1993) and Goldman (1989, 1995, 1992) assume self-knowledge in the process of simulation; in other words, the possession and recognition of target-relevant mental states and prior experience of those mental states are viewed as prerequisites for the simulation process. The simulator agent, then, by accessing his

or her own experience of mental states produced under the feigned, simulated perspective, uses him- or herself as a model to simulate the mental state of another. Harris (1989) and Goldman (1989, 1995) proposed that, by using him- or herself as a mental model, the simulator agent implicitly asks him or herself to consider what he or she should do if he or she entertained the relevant belief and desires of the target agent. In this respect, the mental states of the simulator agent are exploited, resulting in an intuitive "feel" for the mental state of the target agent (Goldman, 1989, 1995). Goldman (1989, 1995) argued that, as an inevitable consequence of being aware of other people *as* others, one automatically projects one's own current beliefs and understanding of the environment onto others. The process of simulation, it is maintained, necessarily entails the introspective awareness of the simulator agent. By putting oneself in another's shoes, one generates a subjective understanding of the source of mental states. The understanding or qualitative "feel" of mental state experiences provide knowledge that allows an informed decision about what to do in the target agent's place.

In contrast to Harris and Goldman, Gordon (1986, 1995, 1996) proposed an account of the simulation process which does not entail introspection. According to his view, mental simulation requires neither self-recognition of the relevant mental states nor an in-depth understanding of mental states. Gordon (1986) contended that simulation requires merely the recognition that mental states occur "at a mental location". Gordon (1996) proposed that the decision-maker arrives at self-ascription and a simulated attribution via a process of *ascent routines*. Ascent routines present mental states for the attribution, such as beliefs and desires in simplified semantic form. These linguistically modified mental states are then fed into the decision-maker and analysed accordingly, without input from introspective awareness of the mental states themselves:

“Thus, if someone were to ask me, (Q1) ‘So you believe Mickey Mouse has a tail?’ I would ask myself, (Q2) ‘Does Mickey Mouse have a tail?’ (with certain constraints on how I obtain the answer to Q2). If the answer to Q2 is Yes, then the presumptive answer to Q1 is Yes (or, ‘Yes, I do believe Mickey has a tail.’) The answer to Q1 is No if either the answer to Q2 is No or no answer is available within the constraints” (Gordon, 1996, p15).

According to Gordon (1996), the ascent-routine procedure enables the simulator agent to arrive at the correct mental attribution without introspective awareness by answering a question about the *object* rather than about a *propositional attitude*. In the case of Mickey Mouse’s tail, for example, the simulator agent need not entertain or access his or her belief about the “tail status” of Mickey Mouse, but merely respond to the object-level question about the Mickey Mouse’s tail (i.e. Does he have one?).

1.2.iii.b Objections to the Simulation Theory

The salient criticism of the simulation theory is that it favours process-driven over theory-driven processes. Theory theorists object to the assertion that mental state attributions may be derived purely from a qualitative feel, without access to a theoretical knowledge base. Churchland (1989) questioned how an individual might use him- or herself as a model for behaviour prediction without a theory about how the model works to begin with. Similarly, Dennett (1987) disputed the assertion that a simulator may arrive at the correct response without directly accessing a relevant knowledge base:

“How can it [simulation] work without being a kind of theorising in the end? For the state I put myself in is not belief but make-believe belief. If I make believe I am a suspension bridge and wonder what I will do when the wind blows, what ‘comes to me’ in my make-believe state depends on how sophisticated my knowledge is of the physics and engineering of suspension bridges. Why should my making believe I have your beliefs be any different? In both cases, knowledge of the imitated object is needed to drive the make-believe ‘simulation’ and the knowledge must be organised into something rather like a theory” (Dennett, 1987, p100-101).

Goldman (1989, 1995) defended the simulation position, claiming that the simulator agent does not manipulate the experimental model to see how it behaves as in Dennett's suspension bridge example. Rather, the simulator uses *him- or herself* as the model, solves the problem of "what to do" in circumstance (*X*), and attributes this decision to the target. Goldman (1989, 1995) contested Dennett's claim that such reasoning must be theory-driven, arguing that simulation may be entirely process-driven if both individuals are driven by the same process and the starting states of simulator agent and target agent are the same or similar.

Another criticism leveled against the simulation theory is that it fails to recognise core knowledge and lay theories held about people or situations in formulating attributions (Churchland, 1989). This objection is, however, readily conceded by proponents of the simulation theory (Goldman, 1989, 1995). Simulation theorists strongly object to the theory theory notion that theoretical knowledge structures are the *primary* mechanisms involved in mental state attribution. The simulation theory holds that information assimilated about human behaviour may produce heuristic generalisations to supplement simulations, but theoretical knowledge is not credited as the fundamental process for mentalising (Goldman, 1989, 1995). The simulation view thus acknowledges that theories of people may be developed through experience and through observations of regularities exhibited in certain behaviours. For example, scripts or schemas may be developed about how people tend to behave in restaurants or when shopping. It is postulated that these scripts are not ignored during simulation processes, but rather are entered into the equation to increase the reliability of perspective shifting. Moreover, the simulation theory concedes that theories of mentalising are incurred, such as the appreciation of the interaction between beliefs, desires and how they are formed (Heal, 1996). Knowledge of what influences people and how perceptual information is related to

belief formation is exploited automatically through the process of simulation; it is argued, however, that this information is not enough to reach a satisfactory prediction.

Stich and Nichols (1992) challenged the simulation account by raising the issue of “cognitive penetrability”. A domain is considered to be cognitively penetrable, according to Stich and Nichols (1992), when new information or knowledge pertaining to that domain influences subsequent performance in the domain. From this view, if evidence suggesting that an individual’s ignorance or knowledge were shown to affect the psychological performance of a task in a particular mentalising domain, then it is unlikely that the mechanism used to arrive at the response was one of simulation.

In a study inspired by Langer’s (1975) “illusion of control” finding, Stich and Nichols (1992) replicated the distribution and “buy back” of sets of raffle tickets from subjects either receiving a choice or no choice of ticket. In her study, Langer distributed raffle tickets in two sets of conditions. One group of subjects was allowed to choose from a selection of tickets, but the second group was given no choice and ticket allocation was experimenter assigned. It was explained to the subjects that because of an administrative complication, the tickets were to be bought back. The findings revealed that those subjects given a choice of tickets sold their tickets back for nearly \$7.00 more than those afforded no choice. In line with Langer’s (1975) finding, subjects in the choice condition set a significantly higher price of nearly \$5.00 more than the no-choice group. With the “illusion of control” finding replicated, Stich and Nichols (1992) showed a second group of subjects one of two videotaped recordings of an actor from the sellback study either choosing a ticket or being assigned one. It was found that when subjects were asked to predict the sellback price of the subjects in the video there was no significant difference in

estimated sellback price. Subjects predicted that those in the no-choice video group set a mean sellback of \$3.47 and the choice video group a price of \$4.62. Stich and Nichols (1992) argued that this finding seriously challenges the simulation theory, for if behaviour prediction made use of an off-line simulation, the simulator would inevitably be able to arrive at the right attribution by asking him- or herself what he or she would do in that situation. Stich and Nichols (1992) reasoned that if it has been shown consistently that people charge more for their tickets when provided with a choice, then the simulator agents should have accurately arrived at this conclusion by off-line decision making. Stich and Nichols (1992) contended that the theory theory is better able to cope with this finding: subjects fail to predict the amount that subjects will sell back their tickets for because they possess no theory of the “illusion of control” and therefore get it wrong.

In defence of the simulation account, Harris (1992) argued that the inaccuracy of Stich and Nichols' (1992) subjects at predicting the “illusion of control” effect may have been due simply to functional aspects of decision making itself, which are not accessible in mental simulation. That is, while perceptual abilities may be used in simulation to create the target's perspective, in some cases the process of imaginative identification cannot simulate *all* aspects of the situation to a satisfactory degree. In some situations, therefore, the input to the decision-maker may not be able to simulate accurately how the circumstances at hand affect the target's psychological processes (Stone & Davies, 1996).

1.2.iv Developmental Simulation Theory

Goldman (1989, 1995) challenged the theory theory's child-as-scientist “theory remodification” hypothesis, arguing that it seems unlikely that all 4-year-olds would be exposed to and independently construct identical and accurate theories at exactly the same time. If the concepts of folk-psychology have proved difficult for

philosophers to define, how can preschool children, as young as 4 years of age acquire a grasp for the relevant laws as proposed by the theory theory (Goldman, 1989, 1995)?

Harris (1992) has provided the most detailed developmental account of young children's mentalising abilities, based on a simulation model. Harris (1992) hypothesised that early prerequisite simulation processes are determined by a built-in mechanism that enables infants to use their own emotional and perceptual system to "echo" the target individual's current perspective of the world. According to Harris (1992), such primitive simulation processes are operating in early actions of joint attention (Butterworth, 1991) and joint emotional stances (Harris, 1989). Harris (1992) proposed that, in these instances, through the utilisation of this self-knowledge, an infant constructs an "on-line" simulation, resulting in sharing of joint attention and of emotional states in the early months of life. Further, late in the first year and increasing throughout the second year of life, children begin to interpret the stance of another by running the system in an "off-line" manner. Rather than being constrained to "on-line" experience of the outputs for action, Harris (1992) maintained that "off-line" processing enables the child to disengage from the decision-maker's outcome for attribution to the target agent:

"The child attributes the stance that is being simulated to the other person, effectively coding the other as 'looking at *X*' or 'liking/wanting *Y*'" (Harris, 1992, p215).

The emergence of acts of teasing and comforting (Harris, 1989), gaze redirection through pointing (Butterworth, 1991), and giving known-to-be desired objects (Rheingold, Hay & West, 1976) are all cited as evidence of the increasing interpretative nature of off-line simulation at this age (Harris, 1992). Around the end of the second year, and increasing throughout the third year of life, it is proposed that

children no longer rely on their own current perceptual or emotional stance toward situations for the process of mental simulation. Instead, children develop the ability to generate “pretend” or imaginary inputs for entry into the executive decision-maker (Harris, 1992). It is hypothesised that this process allows the child to be freed from his or her own current stance of the world, thus enabling the child to represent a target agent’s perspective that is different from his or her own perspective according to the pretend inputs. The “pretend” inputs contradict what the child currently understands to be true of reality, enabling him or her to disengage from the true state of affairs and reason according to an alternative perspective.

The simulation theory posits that, through increasing powers of imaginative identification, children begin to acknowledge that individuals may differ in mental stance and thus may interpret objects differently. Evidence supporting this position comes from children’s increasing ability throughout the third year to acknowledge, for example, that another may see, want, like or know something that they do not (Flavell et al., 1981; Harris, 1991; Wellman, 1990).

Harris (1996) maintained that false belief tasks are difficult for children before 4 years of age because of the complexity of the simulation required for success. Harris (1992, 1995) argued that false belief tasks serve, by their very design, to block the simulation process of using oneself as a model. That is, false belief attributions require that the child first acknowledge the idiosyncratic status of the other (i.e. a child might not want something that the other does) and then adjust the inputs accordingly. Success on false belief tasks, then, would require that the child imagine what it is like *not* to know the current reality of the situation, make the relevant adjustments to the default mechanism which operates on reality as an assumption, generate a response based on the adjusted inputs and then attribute this to the target agent (Harris, 1991). From this perspective, failure on such tasks is due to the

complex nature of the required simulation, rather than a lack of ability to attribute mental states to others.

Evidence cited in support of this position comes from studies employing modified false belief tasks, in which performance has been shown to be bolstered when the solution can be generated at a level of action rather than at a propositional level. For example, Freeman, Lewis and Doherty (1994) found that children who had failed the unexpected transfer Maxi false belief task performed better when asked to *show* where the protagonist would look for the displaced object. In a second study, Freeman et al. (1994) found that young children were significantly better at responding to false belief questions pertaining to where the protagonist will *look for* a displaced object as opposed to where the protagonist *thought* the object was. Similarly, Clements and Perner (1994) found that, while children often fail the false belief test question, their eyes tend to look in the area of the appropriate response. The findings of these investigations may suggest that children perform better at false belief attributions when the imaginative identification task demands are reduced.

1.2.v Information-Processing Accounts of Mentalising Development

Recently, researchers have begun to propose alternative hypotheses to the simulation and theory theory's child-as-scientist accounts of mentalising development, proposing that the increases in mentalising capabilities throughout the preschool years are a reflection of the development of various information-processing and practical-reasoning processes (e.g. Leslie, 1994b; Mitchell, 1996; Russell, Mauther, Sharpe & Tidswell, 1991; Zelazo & Frye, 1996). Unlike the theory theory and simulation hypotheses, information-processing accounts have not arisen out of theories that attempt to explain the underlying mechanisms of adult mentalising. Information-processing accounts are unique in that they are purely developmental and say little about the processes of adult mentalising. Regardless of the adult outcome,

information-processing accounts explain mentalising development in terms of increases in *executive functioning*. Executive functions are processes mediated by the prefrontal and frontal cortex identified as necessary for goal-directed behaviour (Hughes, 1998; Shallice, 1988). Executive functions include the processes of working memory, planning, inhibitory control and attentional flexibility (Duncan, 1986).

A predominate focus of information-processing accounts of mentalising development is to explain the types of errors exhibited by young children when making mental state attributions. It is well documented from tasks of false belief that young children, before the ages of 4 to 5, will incorrectly attribute a belief based on the current physical reality of the situation rather than attribute the outdated belief of a protagonist (e.g. Gopnik & Slaughter, 1991). For example, younger preschoolers will predict during the unexpected transfer Maxi false belief task that the protagonist will search for the ball in its current relocated position, rather than base his search on his outdated belief that the ball is in the original location. Similarly, when tested on the deceptive box Smarties false belief task, children at this age will incorrectly predict another's false belief about the contents of the box, or fail to acknowledge their own earlier belief about its contents (i.e. sweets) by indicating the current contents of deceptive box (i.e. pencils). Errors of this type are called *realist errors*, in that there is a bias to make judgements toward the current state of reality. While most information-processing theorists agree that processing deficits result in a predisposition to be drawn to current reality in early childhood, there is considerable theoretical dispute as to the developmental mechanisms which underlie these early processing constraints.

1.2.v.b Realism and Fodorian Modularity

Recall that Fodor's (1992) modularity account of development proposed that mentalising capabilities depend on the maturation of innate, domain-specific

mechanisms or modules which mature independently through the preschool years.

Once all early modules are in place, a module for mentalising comes on-line⁶.

According to this view, young children are endowed with a “Very Simple Theory of Mind”(VSTM) (Fodor, 1992). The VSTM restricts the child to a primitive understanding of the relationship between various folk-psychological principles. By this view, regardless of how much experience is acquired in the early preschool years, the primitively organised folk-psychological information based on the VSTM may not be remodified or enhanced until maturity (Fodor, 1983, 1987). Developmental increases in mentalising are said to be the products of changes outside pre-representational systems. The adult “Theory of Mind Module” may come on-line only when various prerequisite modular processes have matured.

Fodor (1992) posited that the VSTM operates by the simple folk-psychological law, which states that people act in such a way as to satisfy their desires. This early law is constrained by a second default rule, which states that people’s beliefs are usually true. By this account, children are able to accurately reason about conditions in which people’s beliefs are false by applying two available hypotheses:

H1: Predict that the agent will act in a way that will satisfy his desires.

H2: Predict that the agent will act in a way that would satisfy his desires if his beliefs were true.

⁶As outlined in Section 1.2.ii.a, Fodorian modularity is premised on a theory theory hypothesis. The present section is intended to provide an overview of nontheoretical, nonrepresentational deficit accounts of mentalising. Fodor’s developmental account of mentalising, however, although from a theory theory tradition, is fundamentally an information-processing account. It is acknowledged that the proposed underlying mechanism of Fodorian mentalising is theoretical; however, Fodor’s hypothesised mechanism of acquisition is processing constrained.

For the sake of computational simplicity, when faced with a complicated mental state attribution such as a false belief attribution, Fodor (1992) proposes that H1 is used by default. In most cases, H1 yields the correct response attribution. For a false belief attribution, this H1 heuristic assumption leads the child to neglect the possibility that beliefs may, on some occasions, be untrue (Fodor, 1992). Fodor (1992) maintains that, although children are likely to default to H1, H2 is available to them early on; however, the information-processing demands are often too high for activation. Therefore, H1 is activated by default when processing resources become strained, and, in the case of standard false belief tasks, an incorrect attribution is made.

Failure on the standard unexpected transfer Maxi false belief task is, by this view, a result of the default to H1. Fodor (1992) suggests, however, that the resources of H2 are in fact available to even very young children. It is hypothesised that there are circumstances in which the child may consult H2 and generate a successful attribution. Under circumstances where the desire of the protagonist (i.e. to collect his or her object) appears to be satisfied by more than one possible search location (i.e. if the object is equally distributed to two, rather just one new location in his or her absence), it is predicted that the child would be stimulated to consult his or her knowledge of the protagonist's belief and thus consult H2. There is some evidence to support Fodor's (1992) prediction as based on this suggested empirical paradigm. It has been shown that false belief performance increases for 3-year-olds on tasks whereby the object of transfer disappears in the protagonist's absence (German, 1995; Wimmer & Perner, 1983).

Fodor (1992) also proposed that, if the object were to be destroyed during the task, knowing the protagonist's desire for the object will not be sufficient, and H2 is therefore likely to be consulted to enable the formulation of the correct attribution.

The findings of modified false belief tasks devised according to this suggestion are mixed. Wimmer and Weichbold (1994) and German (1995) tested the split-location suggestion. In this unexpected transfer Maxi false belief paradigm (Wimmer & Perner, 1983) the bait was equally distributed between two locations during the protagonist's absence. Contrary to Fodor's (1992) prediction, children's performance on this task was not bolstered in comparison with a standard control task. In an earlier modified false belief task study devised by Wellman and Bartsch (1988), however, the split location in an inferred belief scenario appeared to increase performance in 3-year-old children. In this paradigm, the child was told that a protagonist's pens were in two locations but the protagonist had only seen them in one of the two. When asked to predict where the protagonist would look for the pens, most children in this study succeeded (Wellman & Bartsch, 1988). This finding was not, however, replicated using a similar procedure in a recent study by Roth and Leslie (1998).

The Fodorian modularity account has been criticised for lack of description and for failure to address and explain the findings of other false belief tasks (Mitchell, 1996). With only partial support found according to Fodor's (1992) predictions, further specification and research into his proposed mentalising mechanism are required.

1.2.v.c Leslie Modularity

To date, Leslie (1987, 1988, 1994b; Leslie & Roth, 1993) has provided the most comprehensive modular account of mentalising development. Like Fodor's modular developmental theory, Leslie (1988) proposed that an innate, modularised mechanism is responsible for mentalising development. Similar to Fodor's account of development, Leslie's theory posited that increases in mentalising abilities during the preschool years are to be understood as performance limitations (Surian & Leslie,

1999). According to this theory, false belief failure does not reflect a fundamental difference between the representational understanding of mentalising between adults and children; rather, it is the unfolding of domain-specific mentalising mechanisms which enable developmental changes in mentalising (Leslie, 1988). On this account, early competence is manifested in a preorganised representational system that subsequently enable modular, domain-specific learning devices called the “Theory of Body Mechanism” (ToBy), and “Theory of Mind Mechanism” (ToMM), which together constitute the basis for the innate acquisition of full-blown mentalising principles (Leslie, 1994b). The ToBy is the proposed innate basis for a theory of physical bodies and the ToMM is posited as the basis for mentalising abilities. According to this view, these devices are specialised components for information incorporation and have a predetermined method of organising the inputs received from sensory systems. These modular devices are said to operate postperceptually as information concerning actions and behaviours is brought in from sensory channels. This account illustrates how, from infancy, children begin to understand and attend to the principles of human agency. The ToMM is therefore the mechanism by which infants, through the observation of behaviour, come to infer associated mental states and how they are formed, without formal teaching (Leslie, 1994b). The ToMM of mentalising capabilities may be considered as analogous to the functionally specialised elements within the visual system which enable shape recognition from representational input about the visual field (Roth & Leslie, 1998).

Leslie (1994b) proposed that the ToMM is “time pressured” in a specialised manner to attend to specific types of information. It is hypothesised that the ToBy develops in the first three or four months life and is a representational system that embodies the infant’s theory of physical objects. The ToBy enables the infant to understand three-dimensional objects as the recipients and transmitters of energy,

while agents have an internally generated energy source that permits unaided movement (Leslie, 1994b). The ToBy uses information attained from visual, kinaesthetic and pressure senses as evidence about the physical world. The ToBy is limited to contact mechanics and does not incorporate information pertaining to cognitive processes of agents, namely, intentional or goal-directional actions (Leslie, 1994b).

It is hypothesised that the first of two ToMM sub-systems, ToMM System-1, emerges at about six to eight months, and ToMM System-2 during the second year (Leslie, 1994b). Throughout the preschool years, children continue to develop increasing capacities to appreciate that possible causes of behaviour may stem from mental states and not just from the physical world (Leslie, 1988). ToMM System-2 employs a more sophisticated representational system, that of “Metarepresentation” (M-representation) (Leslie, 1994b). The ToMM System-2 permits the representation of an agent holding particular attitudes toward the truth of propositions.

According to Leslie’s theory, false belief failure in preschool years is due to performance difficulties and task demands based on an interaction with systems and features tasks (Leslie, 1994b). In other words, the task demands of certain belief tasks, namely standard false belief paradigms, tap limitations of nonmental processing mechanisms rather than revealing anything about mentalising abilities *per se* (Leslie, 1994b). By this notion, Leslie’s theory is similar to Fodor’s (1992) explanation of mentalising difficulties in the preschool years. Leslie, also like Fodor (1992), posited that a good strategy in the attribution of beliefs is to abide by the default rule which states that contents of beliefs are true (Leslie & Thaiss, 1992). The limitations of the ToMM as a modular mechanism are revealed when task demands require the child to set aside a current reality and resist the default assumption (Roth & Leslie, 1998).

It is hypothesised that false belief failure in the early preschool years is due to immaturity of the cognitive system, namely the failure to inhibit a default strategy (Leslie & Polizzi, 1998). By this view, to pass standard false belief tasks, such as identifying Maxi's false belief about the location of his displaced chocolate in the unexpected transfer Maxi false belief task, the child must first identify the true belief content (the chocolate has been relocated and is now in a second location), then disengage from this belief content via the process of inhibition, and then must move on to entertaining the nonfactual content of the false belief (the chocolate is in first location) (Leslie & Polizzi, 1998; Roth & Leslie, 1998).

Leslie (Leslie & Polizzi, 1998; Leslie & Roth, 1993; Leslie & Thaiss, 1992) proposed that false belief success requires an additional executive processing unit to supplement the ToMM, dubbed the "Selection Processor" (SP). The SP locates the competition between two possible belief contents, one which represents physical reality and one which does not (Roth & Leslie, 1998). The SP is an information-processing unit that is nonmental specific (Leslie & Polizzi, 1998). By this view, successful false belief attribution depends on computational resources to solve the questions of the task, regardless of whether the relevant belief content is true or false. In other words, it is not the falseness or the representational nature of the beliefs that is difficult for the child, but the SP resources required by the task in relation to the availability of those particular resources at a particular stage of development (Roth & Leslie, 1998). The ToMM provides the competence in the mental domain, and the SP provides the performance competence; false belief failure at 3 years of age results not from lack of ToMM competence but from poor SP performance. When a child errs on a false belief task, it is because he or she has failed to attend to the false belief. In time, and through maturation and experience, the mechanisms for inhibiting the truth default strategy increase and the child is able to attend to and identify false beliefs

when necessary (Scholl & Leslie, 1999). According to the ToMM-SP hypothesis, the ToMM and the SP must work in tandem to solve false belief attributions and overcome the processing demands required for the attribution (Roth & Leslie, 1998).

By this view, children are innately endowed to solve belief attributions but are not guaranteed success on every type of paradigm, depending on the nature of the task demands themselves:

“Success will depend upon the exact constellation of problem solving resources required by a given task and upon availability of these resources at a given point in development. Their [children’s] competence may be ‘squeezed’ by a number of performance factors. It is plausible that, as a result of maturation, learning, practice or all of these, performance ‘squeeze’ will gradually relax over time” (Roth & Leslie, 1998, p17).

The ToMM-SP hypothesis does not posit developmental trends in mentalising abilities; rather, task difficulty will depend on how easy it is for the child to calculate the belief content, which will depend on the task structure details in relation to the SP (Roth & Leslie, 1998). Support for this notion comes from studies in which some true belief attributions are shown to be as difficult as false belief attribution (Roth & Leslie, 1998) and from modified tasks of desire whereby children’s performance is shown to be as low as that for belief (Gopnik & Slaughter, 1991). Similarly, Moore, Jarrold, Russell, Lumb, Sapp and MacCallum (1995) found that, while 3-year-olds were successful on tasks of desire, it was not until the age of 5 that children succeeded at desire tasks in which they had a strong conflict. In a recent study by Polizzi and Leslie (1999), children who demonstrated success on standard false belief understanding as the inclusion criterion to the study were shown to fail a false belief task which entailed a negative desire component.

Evidence in support for a more general processing constraint of the SP on false belief performance comes from other tasks that require similar processing requirements as false belief tasks but without the mental state content. For example,

in Zaitchik's (1990) nonmental false-photograph procedure, performance is similar to that on standard false belief tasks. In this task, the child takes a Polaroid snapshot of a protagonist lying on a mat. Before the photograph has developed, a second protagonist replaces the protagonist, and the child is asked to report which protagonist will appear in the photograph. The findings showed that 4- but not 3-year-olds succeed at this task. Roth and Leslie (1998) argued that the difficulties shown by 3-year-olds in both false belief and nonmental false-photograph task are due to limitations of the SP, which result in the miscalculation of the belief content when it is false.

In order to test this notion further, Roth and Leslie (1998) devised a series of empirical paradigms. One task, "the screen task", was aimed to model the structural content (and thus processing load for the SP) of a standard unexpected transfer Maxi false belief task; however, the task contained nonmental or nonrepresentational content. In this procedure, a basket and a box were shown to the child. A marble was placed in the basket, and both containers were placed behind an opaque screen. A second set of containers, identical to those placed behind the screen, was introduced to the child. Again, the marble was placed in the basket but was later moved to the box. The child was asked to report which container the marble is in behind the screen. It was argued that this task would tax the SP in the same way as a standard false belief task, in that one aspect of the situation must be selected in the face of intrusion by another salient and confusing aspect. That is, the child will be required to hold separately two very similar but conflicting states of affairs.

A second task (the "search task") aimed to reduce the processing load of the SP while still targeting mentalising ability. For this task, the children were introduced to a brother and sister who are playing outside. The sister states her desire for some biscuits and heads straight to the kitchen cupboard to get a biscuit and returns outside

to her brother. The brother then expresses his desire for a biscuit, and heads to the kitchen. The brother, however, sees a biscuit tin on the table, searches unsuccessfully for a biscuit, exclaims that his sister must have eaten all of the biscuits and returns outside, empty-handed. The children were asked to report the location at which the brother and sister thought the cookies would be when they entered the kitchen. It was proposed that this task would tax the ToMM but not the SP; that is, the identical desire but conflicting satisfaction results, coupled with the exclamations of mistaken assumption by the brother, would facilitate the SP to select the appropriate information for the belief content (Roth & Leslie, 1998). The results showed that standard false belief performance as assessed by an unexpected transfer Maxi false belief task was significantly correlated with the nonmental screen task for 3- and 4-year-olds. The search task was correlated with standard false belief but not with the screen task. Leslie and Roth (1998) interpret these findings as evidence indicating that the problem young children have on belief problems, which is also shared in the nonmental screen task, is with selection processing. Further evidence in support of a SP limitation comes from studies showing that young children's false belief performance can be enhanced when the SP processing demands are lowered (Freeman, 1994; Mitchell & Lacohee, 1991; Saltmarsh, Mitchell & Robinson, 1995)⁷.

1.2.v.d Reality-Masking Hypothesis

An alternative realism explanation of the developmental increases in preschool mentalising abilities, "the reality-masking hypothesis" has been put forward by Mitchell and colleagues, (Mitchell, 1994, 1996; Mitchell & Lacohee, 1991; Robinson, Mitchell, Isaacs & Nye, 1992; Saltmarsh, Mitchell, & Robinson, 1995). This view is consistent with the Leslian and Fodorian hypotheses that it is not young children's lack of a conceptual understanding of misrepresentation that causes failure on tasks of

⁷ These studies will be further discussed in Section 1.2.v.d.

false belief. Failure is considered to be a symptom of broader, nonrepresentational cognitive-developmental deficits. Mitchell (1996) posited that very young children are endowed with a symbolic ability to permit language acquisition and the ability to understand pretend play. By Mitchell's (1996) view, the attentional systems of young children are evolutionarily predisposed to be dominated by reality. According to Mitchell (1996), realism is only to a matter of degree, as pretence in itself is already once removed from reality, indicating that children have some ability to override reality bias. Mitchell (1996) proposed that the young child, during his or her period of protected immaturity in the preschool years, is drawn to reality in order to establish his or her position as a goal-directed agent in a world filled with objects and people. According to this view, attentional resources to beliefs are sparse at this time, for within the context of his or her protected immaturity, proficiency of social skills should not determine or undermine his or her care. The primary focus of the first years of life is to place himself or herself in the world and thus attentional resources are prioritised to orient toward reality. By preschool age, social skills become of greater importance, as the period of unconditional protected immaturity wanes; at this point the individual is increasingly required to attend to beliefs, in order to successfully interact in the social world (Mitchell, 1996).

Like modular accounts of mentalising, the reality-masking hypothesis proposes that representational understanding may be intact before success on various tasks of false belief attribution is demonstrated. The poor performance elicited on tasks of false belief in the early preschool years is considered to be task-specific in nature and to reveal little about young children's representational abilities. Support for the reality-masking hypothesis has come from studies in which children's false belief performance is shown to be facilitated when the information-processing load is minimised by the reduction of the salience of physical reality. Mitchell and Lacohee

(1991), for example, adapted the standard deceptive box Smarties false belief task by asking children to post a picture of what they thought the contents of the Smarties tube was *prior* to the opening of the tube. It was found that many children who went on to fail the standard Smarties false belief task were successful when tested under the posting condition. Mitchell and Lacohee (1991) concluded that the relevant picture-posting condition provided the children with a “reality counterpart” acting as a memory tracer to override the reality salience of the deceptive contents of the box. Replication attempts using this type of procedure have been mixed. Successful replications have been reported by Charman and Lynggaard (1995), Freeman (1994) and Freeman and Lacohee (1995), while other researchers have found little or no significant facilitative effects (Robinson & Goold, 1992; Robinson, Riggs & Samual, 1996). Freeman (Freeman, 1994; Freeman & Lacohee, 1995) expanded this paradigm using a deceptive egg carton, asking children in one condition to post a drawing of an egg, in a second condition to post a real egg, or in a third condition to post an egg carton as a depiction of their initial belief about the contents of the carton. While performance was marginally facilitated by the posting of the real egg or egg carton, nearly all of the subjects in the picture-posting condition were successful on the task.

Other methodological manipulations to the deceptive box Smarties false belief task have shown that children are capable of passing the false belief task at a younger age when the focus of current reality was eased. For example, when given various suggestions by the experimenter concerning the child’s earlier belief about the contents of the box, 3-year-olds demonstrated success in attributing false beliefs (Mitchell & Isaacs, 1994). In this study the experimenter told 3-year-old children that they (the children) had initially thought Smarties were in the box and all agreed with this correct suggestion. Furthermore, the children in a control condition given the inaccurate suggestion of their initial belief about the contents of the tube (i.e. Jelly

Babies) were more likely to disagree and go on to report accurately their initial false belief. Further evidence in support of the reality-masking hypothesis has also come from modified versions of the unexpected transfer Maxi false belief task. German (1995), for example, found that children's performance was facilitated when the experimenter ate the chocolate after transferring it to the second location. German (1995) also found that 3-year-old children who witnessed a video of themselves making false belief-based search for their chocolate (which had been moved) were also more likely to correctly indicate that they thought the sweet was where they had originally left it. Saltmarsh & Mitchell (1996) replicated this facilitative finding using a deceptive box Smarties false belief task video paradigm. Bartsch and Wellman (1989) adapted the unexpected transfer Maxi false belief task by asking children to explain the erroneous search of a protagonist as based on their false belief. The findings revealed that children as young as 3 years of age successfully explained the wrong search in term of false beliefs (Bartsch & Wellman, 1989). In another modified unexpected transfer Maxi false belief task, Robinson and Mitchell (1995) found that most 3-year-old children were successful at inferring which of two identical twins had been absent during an object transfer as evidenced by his incorrect search. The children, however, showed classical difficulties in predicting where the absent twin would search upon his return. Robinson and Mitchell (1995) argued that this finding provides further support for the notion that, when the reality salience is reduced via means of a reality tracer, in this case the twin's incorrect search, belief performance can be enhanced.

Other empirical modifications to standard false belief tasks which appear to reduce the salience of reality have shown evidence *against* the notion that it may be children's bias towards current reality that is responsible for failure on false belief tasks. Wimmer and Hartl (1991), for example, found that 3-year-old children were

not overburdened by the salience of reality in their modified deceptive box Smarties false belief task. Rather than a deceptive content, in this paradigm, the initial content of the tube was in fact, Smarties, but when the tube was opened the Smarties were removed and replaced with a pencil. When asked to recall their initial belief about the contents of the tube, the children committed no realist error by responding correctly with “Smarties”. Wimmer and Hartl (1991) suggested that young children interpret the test question as a question about the initial contents of the box rather than a question about their initial belief content, and therefore succeed.

Saltmarsh, Mitchell and Robinson (1995) devised a series of studies to test this hypothesis. In one study, a procedure similar to that of Wimmer and Hartl (1991) was adopted, however, once children were shown the Smarties tube it was opened to reveal the unexpected contents of a pencil, which was then replaced by straw. When asked about their initial belief concerning the contents of the tube, the children in this study made the classic realist error by responding “straw”. This finding poses difficulty for Wimmer and Hartl’s (1991) misinterpretation of the test question explanation, for on this account the children should have answered “pencil”. Mitchell (1996) argued that performance may have been enhanced in the Wimmer and Hartl (1991) study as the initial contents of the box were Smarties: this could have provided the crucial reality tracer to enable disengagement from current reality. In a second study, children and a protagonist were shown Smarties tube and were asked to guess what was inside. After both answered, the protagonist exited the scene, and the child witnessed the replacement of the Smarties with a pencil. The findings of this study revealed that children in this condition were more likely to make a correct false belief judgement (i.e. that the protagonist would think there were Smarties inside the box) than they were in a control condition, where the tube contained pencils from the beginning. Saltmarsh et al. (1995) interpret this finding as showing further support

for the notion that when a reality-counterpart is present, false belief performance may be facilitated by the reduction of current reality salience.

1.2.v.e Realism and Executive Control

Russell (e.g. Russell et al., 1991; Russell, Jarrold & Potel, 1994) was amongst the first investigators to propose that young children's difficulty with false belief attributions may not be due to an underlying difficulty with representing mental states but instead a result of more general executive control deficits. Russell et al. (1991) proposed that executive inhibition limitations might be responsible for young children's tendency to be drawn toward the current state of the physical reality without consideration of knowledge relating to mental states. Russell et al. (1991) argued that standard false belief tasks, such as the deceptive box Smarties task and the unexpected transfer Maxi task, with their great verbal and narrative demands, reveal little about children's capabilities in the domain of mentalising. It was proposed that these tasks require the inhibition of cognitively salient information, that of current reality, so that the key element to success is not the understanding of beliefs *per se*, but the ability to disengage from the currently held belief about reality and to predict accordingly (Moore, Jarrold, Russell, Lumb, Sapp & MacCallum, 1995). By this view, deception is purer test of mentalising abilities, in that a task of deception is one whereby one attempts to *influence* another's belief, by telling them the opposite of what is currently known to be true rather than just predict the false belief of another (Russell et al., 1991).

In order to test this notion, Russell et al. (1991) devised a deception task dubbed the "windows task". In this procedure, two boxes are placed in front of the child, one containing a sweet, the other being empty. The rules of the game are as follows: if the child points to the box with the sweet inside, the experimenter rather than the child keeps the sweet. If, however, the child indicates the empty box, he or

she may keep the sweet for himself or herself. During an initial training phase to familiarise the child with the rules of the game, the child does not know which of the boxes contains the sweet. During the testing phase, however, the contents of both boxes are made visible to the child. In order for the child to succeed in winning the sweets for himself or herself, he or she must suppress his or her knowledge of the location of the sweet and indicate the empty box to the experimenter. Success on this type of task requires disengagement from current knowledge of the sweet's location and referencing away from the baited box (Russell et al., 1994). Results using this paradigm revealed that most 3- but not 4-year-old children erred on the first trial by selecting the box of the current location of the sweet. Moreover, the 3-year-olds tended to persevere with this reality bias on subsequent trials despite losing the sweets to the experimenter (Russell et al., 1991). In a similar study, Hala, Russell and Maberley (1995) found that when children were asked to select a box during the windows task using a pointer rather than indicating by pointing with their fingers, performance was enhanced in 3-year-old subjects. It was argued that the pointer distanced the child from his or her current intention to communicate, and thus reduced the processing demands of the task. This finding was interpreted as evidence in support of the executive control hypothesis, as when the executive demands of the task are lowered the prepotent response is successfully inhibited (Hala et al., 1995).

Carlson, Moses and Hix (1998) investigated the impact of reduced inhibitory demands on young children's false belief and deception performance. In a series of studies, 3-year-old children were asked to deceive a protagonist who was ignorant of an object relocation into making an erroneous search for the object. In other words, it was the child's task to influence the protagonist to look in the wrong location for a displaced object. In one condition the children indicated by pointing to the search location; in a second condition the children placed a photo of the object at the search

location. The results supported those of Russell et al. (1994), showing that 3-year-old children performed significantly better in the photo condition than in the pointing condition. These findings show further evidence for the notion that inhibitory control may play a greater role in early false belief failure than was initially suspected. That is, when the physical salience of the target object is reduced via the use of pointers, as in Russell et al.'s (1994) windows task or by the use photographs in the Carlson et al.'s (1998) deception task, performance is enhanced.

Perhaps the most thorough attempt to investigate the development of early executive functioning processes was conducted recently by Hughes (1998). In this study, Hughes (1998) adapted adult versions of neuropsychological tests or tests reliably used to test prefrontal function in animals to measure the three key factors of executive function: working memory, inhibition of maladaptive prepotent response, and attentional set-shifting. Working memory was measured via a visual search task whereby, following an introduction to eight covered sweet-baited containers, the containers were covered and spun, and the child was encouraged to select a container. On the initial trial, all containers were baited, and the child was allowed to keep the sweet. The containers were covered and spun again, and it was the child's task to select a pot that he or she had not yet looked in for the remaining trials. A second working memory task consisted of the repetition of various two-item and three-item sequences by selecting appropriate keys from a "noisy book". Inhibitory control was assessed using Luria's hand game and the "detour reaching box" developed by Hughes and Russell (1993). The child was introduced to Luria's hand game by copying hand actions of either a pointed finger or a clenched fist as demonstrated by the experimenter. The testing phase entailed the child producing the opposite or conflicting action to that of the experimenter. If the experimenter pointed her finger, the correct response would be to make a fist. In the detour-reaching box, the child

was shown an apparatus whereby a ball is inaccessible if the child attempted to reach in and retrieve the ball. The ball could only be released by following a sequence of steps, which included turning a knob when a yellow light was on and by pushing a switch down when a green light was on. Attentional flexibility was assessed by a magnet pattern task whereby the child was shown an 18 item sequence and was asked to reproduce and continue various patterns. A second attentional flexibility task entailed the child sorting stickers according to the rule switches of two key dimensions: colour and shape.

Hughes (1998) found that, when age was controlled, significant correlations were observed between performance on false belief prediction tasks and working memory. Significant associations were also found between inhibitory control and false belief explanation and deceit. Even with age and verbal IQ accounted for, attentional flexibility and inhibitory control were significantly correlated with scores on deceit. These findings provide further evidence against a representational deficit explanation of early mentalising difficulties, and suggest that various executive functions are related, albeit differentially, to performance on various mentalising tasks (Hughes, 1998).

1.2.v.f Changes in Reasoning: Counterfactual and Rule-Based

Other theorists support nonrepresentational deficit accounts of mentalising development in favour of executive-function reality-bias accounts. They argue, however, that young children may have a wider difficulty with general reasoning, such as with inferring or recalling counterfactual situations, regardless of whether the content is mental or not, (Riggs, Peterson, Robins & Mitchell, 1998) and with rule-based reasoning (Frye, Zelazo & Palfai, 1995).

Standard tasks of false belief such as the deceptive box Smarties task and the unexpected transfer Maxi task are premised on a counterfactual component in that a

situation happens to be held as a true belief by the protagonist (i.e. the belief that “object is location A”) despite this belief being counter to the true state of reality (i.e. the fact that the object is really in location B) (Riggs et al., 1998). Standard false belief tasks also require an element of rule-based reasoning for success. In order to succeed, an individual must ignore one perspective while making an inference from another perspective, a process which requires the use of embedded rules (Frye et al., 1995). Both the counterfactual and rule-based reasoning hypotheses predict that nonmental reasoning tasks using counterfactuals or embedded rules should show similar trends in developmental difficulty if related to false belief performance.

In a series of studies, Riggs et al. (1998) tested this hypothesis by investigating the relationship between tasks, which required the acknowledgement of nonmental counterfactual physical states and those of counterfactual mental states (false belief). The findings showed a strong correlation between young children’s performances on the two types of tasks. Riggs et al. (1998) interpreted this finding as an indication that the realist bias exhibited by young children on tasks of false belief extends beyond the belief component and occurs as often on tasks which require a similar acknowledgement of counterfactuality but not an understanding of representations.

In a series of studies, Zelazo and colleagues (Frye, Zelazo & Palfai, 1995; Zelazo, Frye & Rapus, 1996) investigated the relationship between the use of nonmental embedded rules and the development of false belief understanding in young children. Frye et al. (1995) developed a two-dimension card-sorting procedure whereby children were asked to sort objects presented on cards by colour and shape. While 3- and 4-year-old children were successful on sorting by the two dimensions (i.e. by colour or by shape), when asked to switch between rules, for example, from sorting by colour to sorting by shape, 5- but not 3- and 4-year-olds were successful. That is, if children were sorting by colour initially, when asked to switch rules and

sort by shape, the children would continue to sort the cards by colour (Frye et al., 1995). Furthermore, performance on the two-dimensional card sort correlated with standard false belief performance, a finding replicated by Hughes (1998). Zelazo and Frye (1996) argued that this correlation between inflexibility in rule use and false belief failure represents the more general executive function limitation of failure to reflect upon knowledge. In other words, false belief and sorting tasks require similar logical structures and mandate self-reflective knowledge, or higher order rules (Zelazo & Frye, 1996). By this view, mentalising development is not a function of the acquisition of a representational understanding of mental states, but is a result of increasing abilities to reflect on one's own cognitive processing in such a way that self-awareness drives developmental increases in a variety of domains such as social interaction, self-understanding and control (Zelazo & Frye, 1996).

1.2.vi Summary

The development of adult mentalising abilities has been reviewed, with particular attention to three perspectives which currently dominate the literature: the theory theory, the simulation theory and the information-processing theory.

The aim of the experiments reported in this thesis is to help clarify and explain the developmental progression of mentalising throughout the early preschool years. To this end, the chapters to follow describe a series of experiments designed to test some of the main tenets and predictions put forward by current developmental theories of mentalising development.

CHAPTER TWO

Experiment One

Teaching False Belief Skills to Young Children: A Test of the Theory Theory “Child-as-Scientist” Hypothesis

2.0 Introduction

Chapter 1 provided an overview of current theoretical explanations of mentalising and development. We have seen how current developmental perspectives based on the main tenets of the theory theory and simulation theory of adult mentalising have dominated the literature. We have also seen how alternative, purely developmental information-processing accounts, have more recently come to seriously challenge traditional views of mentalising development. The aim of the empirical work presented in this thesis is to further explore the different predictions of each of the three main developmental theories of mentalising: the theory theory, the simulation theory and the information-processing theory. Since the theory theory is often considered the dominant theory of mentalising by researchers in the field, this chapter will introduce the empirical work of this thesis by considering the theory theory. In particular, the specific predictions of the developmental child-as-scientist hypothesis will be reviewed.

2.0.i Developmental Theory Theory: The Debate

As we saw in chapter 1, many developmental psychologists, building on the basic philosophical tenets of the theory theory, have proposed that the steady increases in mentalising abilities throughout the preschool years are grounded in the development of an immature, central, theorylike mechanism (e.g. Fodor, 1992; Gopnik & Meltzoff, 1997; Perner, 1991; Wellman, 1990). Although the

developmental theory theory remains a dominant view in the literature, there is considerable internal dispute between theory theorist rationalists on the one hand and theory theory empiricists on the other, concerning the proposed development of mentalising abilities.

The rationalist theory theory hypothesis proposes that the underlying folk-psychological mechanism of mentalising is based on the maturation of innate, domain-specific modular structures (Fodor, 1992). By this modular theory theory view, mentalising development is due to the maturation of various functionally specialised, predetermined mechanisms. By this account, the capacity for mentalising in early childhood matches that of adult mentalising; however, limitations of certain immature non-mentalising modular systems result in mentalising *performance* errors as opposed to errors of *competence* in the domain. That is, the ability to exploit existing mentalising abilities in early childhood is constrained by processing limitations (Fodor, 1992). By this view, mentalising development is predetermined by module maturation and may not be overturned through experience. Rather, changes throughout the preschool years are due to changes outside the representational system, namely in increases in the capacity for information-processing. This theory theory view posits that a mentalising module may come on-line only after other prerequisite mechanisms related to information-processing have matured.

From a theory theory empiricist or child-as-scientist view, however, early difficulties in mentalising are a reflection of competence errors in the domain. That is, development is an active process whereby children construct “layperson theories” about the world that regulate their perception and understanding of the world around them. By this account, experience in the realm of mentalising penetrates initial primitive folk-psychological theories and trigger stagelike remodifications of these

early theories (e.g. Forgyson & Gopnik, 1988; Gopnik et al., 1994, Gopnik & Meltzoff, 1997). According to this view, children are endowed with structures which govern the input to and organisation of the representational system in such a way that there is an innate predisposition to reformulate initial primitive theories over time (Gopnik & Meltzoff, 1997). Unlike the modular theory view, the child-as-scientist view proposes that the innate mechanism is not encapsulated in development but rather, in face of conflicting data via experiences is a defeasible (revisable) theoretical knowledge base (Astington & Gopnik, 1991a; Gopnik & Meltzoff, 1997; Gopnik & Wellman, 1992). The process of cognitive development by the child-as-scientist account is considered analogous to scientific theory change. When sufficient evidence is accumulated through experience, earlier less-informed theories will be revised and replaced with newer, more accurate theories.

Evidence cited in support for this child-as-scientist hypothesis comes from well-replicated developmental trends in mentalising abilities observed throughout the preschool years. That is, children consistently display stagelike trends in their regulation of perception and understanding of the world around them. For example, it is well documented that Level-1 visual perspective taking abilities emerge before those of Level-2 visual perspective taking, both of which emerge prior to or, in the case of Level-2 visual perspective taking abilities, simultaneously with false belief understanding (Astington & Gopnik, 1991b; Flavell et al., 1981). From this view, success on tasks of Level-1 visual perspective taking, for example, requires a less sophisticated theory than for Level-2 visual perspective taking task success. Similarly, more basic Level-2 visual perspective taking tasks may not require the advanced theoretical knowledge system, as do the more difficult tasks of false belief or appearance-reality. Thus, success on tasks of Level-1 visual perspective taking but failure on tasks of Level-2 visual perspective taking and false belief, for example, are

explained as a consequence of an early, primitive theory of mentalising. In this respect, these capabilities are hierarchically organised. Level-2 conceptual understanding follows the prerequisite Level-1 understanding but Level-2 understanding may not precede Level-1 abilities. The observed developmental trends in mentalising understanding (e.g. Level-1 to Level-2 visual perspective taking, false belief and appearance reality) are explained as a series of conceptual theory remodifications throughout the preschool years.

While the modularity and child-as-scientist views are presently the two main developmental theory hypotheses, little research has been conducted attempting to directly assess these differential developmental hypotheses. A mentalising training scheme methodology is one method by which these views could be tested empirically. By the modular theory account, a training scheme targeting mentalising skills at a conceptual level of understanding would be expected to be largely ineffective. According to this view, performance rather than conceptual deficits in mentalising are assumed to be the young child's difficulty in this domain. According to this view, mentalising development is constrained by the maturation of encapsulated mentalising modules that are not affected by new information or experience; as such, a training scheme should not impact on performance in the domain unless it was specifically devised to target specific information-processing abilities, such as memory and attention. In contrast, from the child-as-scientist view, early mentalising theories are hypothesised to be defeasible in nature and can be modified with sufficient relevant experience or "data", as such mentalising performance would be expected to increase as a consequence of trained theory reformation.

A training study research strategy is a useful tool to test these theoretical predictions and is of importance because of the limited conclusions that can be drawn

from cross-sectional studies in developmental psychology. Such studies often demonstrate a coincidence of change in possibly related developmental accomplishments without providing evidence of a true developmental relationship (Bradley & Bryant, 1983). Recently, the methodological appeal of training studies in investigating mentalising development has been exploited in a number of studies. The sections to follow include a review the procedures and findings of such investigations.

2.0.ii Training Studies: The Empirical Evidence

The results of the few mentalising training studies have been mixed. In an early attempt to teach Level-2 visual perspective taking abilities by encouraging children to physically investigate various visual perspectives, Flavell et al. (1981) showed that children's Level-2 visual perspective taking performance improved only slightly after training. This improvement was not considered sufficient to demonstrate a true conceptual grasp of Level-2 understanding and it was concluded that the children merely switched from an "egocentric responding" style at pre-testing to a "random responding" style following training (Flavell et al., 1981). Two other early studies in the area suggest that the real-apparent distinction also can not be successfully trained in young children (Flavell, Green & Flavell, 1986; Taylor & Hort, 1990). In the Flavell et al. (1986) training study, children were exposed to a series of training trials which demonstrated how an object, when viewed through a coloured filter, may appear to be another colour. Following this experiential training, children's real-apparent distinction performance did not improve. Taylor and Hort (1990) also attempted to train the appearance-reality distinction using coloured filters to change the apparent colour of objects. Taylor and Hort's (1990) findings did not show any significant pre-test, post-test increase in performance following the training, nor did a similarly trained group of children outperform a nontrained control group in

a subsequent study. Moreover, studies attempting to teach mentalising concepts to individuals with autism have shown that while training may lead to training-related task improvement, these effects do not significantly generalise to transfer tasks for these individuals (McGregor, Whiten & Blackburn, 1998; Swettenham, 1996).

Swettenham (1996) and McGregor et al. (1998) suggest that this lack of generalisation to novel mentalising tasks may be taken as evidence that while task-specific learning occurs, individuals with autism do not demonstrate an increased conceptual understanding of mentalising principles following training.

Recently, several studies attempting to train mentalising abilities related to false belief understanding to young preschool children have been reported in the literature (Appleton & Reddy, 1996; McGregor et al., 1998; Slaughter, 1998; Slaughter & Gopnik, 1996; Swettenham, 1996). The findings of these investigations lend support to the view that the mentalising ability of false belief may be successfully trained. Before developing further discussion of these training studies, it is important to note that, while all five investigations attempted to teach false belief skills to young preschoolers, the McGregor et al. (1998) and Swettenham (1996) studies were devised with the primary aim of teaching false belief skills to children with autism. In these studies, typically developing children were trained as controls to the trained groups of children with autism. The McGregor et al. (1998) study included two groups of typically developing children: one group of trained 3-year-old children to serve as a control to the trained autistic sample and a second group of nontrained typically developing children to serve as a control group to the trained group of typically developing children. McGregor et al. (1998) used an errorless training technique to train their subjects by highlighting protagonists' intentions and supplementing false belief scenarios with the "picture-in-head" illustration technique as first developed by Swettenham, Baron-Cohen, Gomez and Walsh (1996). The

findings showed that the control sample of typically developing 3-year-olds significantly outperformed the control group on the training related post-test and two out of the five non-training related post-tests (McGregor et al., 1998).

In the Swettenham (1996) investigation, like the McGregor et al. (1998) study, two control groups were used: a group of typically developing 3-year-olds included as a control group for the autistic sample, and a group of children with Down's Syndrome were trained as a control for the autistic sample. A second group of nontrained typically developing children was not included. With no control group to compare the trained 3-year-old's performance with, it is difficult to conclude whether any potential effects of the training scheme were a result of training or a consequence of natural development. The findings, however, do enable pre-test, post-test improvement comparisons for this group as an indication of the training scheme's effectiveness. The findings suggest that the training scheme was of some benefit to the typically developing children. Although generalisation effects were not formally analysed for the control group, at least some generalisation was observed with five of the eight typically developing children showing success on at least one of three nontrained post-tasks (Swettenham, 1996).

Slaughter and Gopnik (1996) devised a training scheme whereby groups of children were trained on mentalising skills over the course of two weeks. The training entailed exposure to trials of various false belief related paradigms, which included a training group of belief, and a second group dubbed the "coherence" group was trained on desires and perceptions. Positive and negative feedback was given throughout the training trials so that counterevidence was provided in the event of incorrect responding. The findings of this study showed the children in both the belief and "coherence" groups significantly outperformed a control group on false belief understanding at the time of post-testing. Moreover in a second study, groups

of children trained on belief and coherence tasks were shown to outperform a control group on tasks of false belief, and also showed significantly higher mean composite scores on other mentalising post-tests. Slaughter and Gopnik (1996) concluded that the success of the belief training shows support for the child-as-scientist notion that children develop increasing abilities in mentalising through experience and exposure to the relevant concepts, contrary to the predictions of the modular theory theory.

Slaughter (1998) replicated and expanded the training effect in a study based on the procedures of Slaughter and Gopnik (1996). False belief training was shown to generalise to perspective taking and appearance-reality performance (Slaughter, 1998). A second group of children in this study was trained on false photograph (Leekam & Perner, 1991; Leslie & Thaiss, 1992) and false drawing tasks (Charman & Baron-Cohen, 1992). Following training, this group was shown to significantly increase in performance on false photographs at the time of post-testing; however, this did not generalise to false belief tasks or other mentalising tasks, nor did false belief training generalise to false picture tasks. In another study, Appleton and Reddy (1996) adopted a discussion training scheme whereby children were encouraged to reflect on the events of various false belief scenarios as depicted in video recordings. At the time of post-testing, children's false belief performance was shown to improve and generalisation to a non-training related false belief task was observed.

Crucially, in the Appleton and Reddy (1996), McGregor et al. (1998), Slaughter and Gopnik (1996) and Slaughter (1998) studies, concept false belief generalisation was observed; that is, training on one type of task served to improve performance on nontrained concepts. These researchers argued that the concept generalisation effects lend further support to the theory theory's child-as-scientist hypothesis, as training on one aspect of mentalising appears to have influenced

performance on conceptually different tasks within the same domain (Slaughter & Gopnik, 1996; Slaughter, 1998).

When taken together, the findings of the training studies described above appear to provide mixed evidence pertaining to the trainability of mentalising capabilities in young children. While early training attempts have been ineffective in demonstrating any significant improvement in performance on some mentalising tasks (Flavell et al., 1981; Flavell et al., 1986; Taylor & Hort, 1986), recent training attempts suggest that some mentalising abilities may in fact be successfully trained in young children (Appleton & Reddy, 1996; McGregor et al., 1998; Slaughter, 1998; Slaughter & Gopnik, 1996; Swettenham, 1996). As with any novel methodological procedure, caution must be exercised in attempting to interpret the implications of the discrepancies between the findings of the studies, particularly as the methodological approaches varied, often considerably between the studies. The sections to follow provide a brief summary and a comparison of the various methodological approaches utilised in these studies, in an attempt to highlight and develop the methodological issues pertaining to the use of mentalising training schemes.

2.0.iii Methodological Differences Between Studies

2.0.iii.a Target Concept

Perhaps the most obvious difference between the successful and unsuccessful training studies reported in the literature is the mentalising skill specifically targeted for training. The two appearance-reality training studies reported were unsuccessful in producing any improvement in appearance-reality performance (Flavell et al., 1986; Taylor & Hort, 1986). A possible explanation for this negative finding could be that appearance-reality may, as an advanced mentalising achievement, have been targeted too early in development. Appearance-reality skills have been shown consistently to emerge later in development than those of false belief (Flavell, 1978;

Flavell et al., 1981; Gopnik & Astington, 1988; Gopnik & Slaughter, 1991), and may therefore require the establishment of certain prerequisite skills for success; prior to emergence of these skills, success is precluded regardless of how much training is received. Furthermore, in the Slaughter and Gopnik (1996) study, children trained on both perspective and desire reasoning were shown to improve in performance on both perspective taking and desire tasks, as well as other related mentalising tasks. While a concept-based explanation for the negative results of these studies is plausible, it is more likely that procedural differences between the successful versus unsuccessful training studies contributed to the discrepancies in the effectiveness of the training schemes.

2.0.iii.b Sampling

One common aspect of the successful training studies are criteria for participant inclusion. Sampling procedure is a particularly important methodological issue in the design of training studies. The establishment of a clear baseline level of understanding of the target skill is necessary to ensure children do not already possess the relevant skill *prior to* the training implementation (See *Table 2.1* for a summary of partial procedural differences between successful training studies). The successful false belief training studies of Appleton & Reddy (1996), Slaughter & Gopnik (1996) and Slaughter (1998) all used the same entry criterion. Children were eliminated from these investigations if success was demonstrated at the time of pre-testing on the “self” or “other” test questions of the deceptive box Smarties false belief task. Similarly, McGregor et al. (1998) included only those children who at the time pre-testing failed at least two out of three false belief tasks, including the two deceptive box Smarties false belief questions and the unexpected transfer Maxi task test question. The most stringent entry criterion observed in a training study to date was adopted in the Swettenham (1996) study, whereby children were included only if, at

the time of pre-testing they failed two "self" and "other" versions of the deceptive box Smarties task, the unexpected transfer Maxi false belief task and one novel false belief based behaviour prediction task.

Table 2.1: Summary of procedures and findings of previous false belief training studies.

	Subjects	Pre-tests	Training	Feedback	Duration	Post-tests/Results (Belief Training Only)
Appleton & Reddy (1996)	N=46 Mean Age: 3:6 23 Trained 23 Control	Smarties Self Smarties Other Entry Criteria: Failure on both	4 Maxi tasks	Discussion sessions: Repetition of Critical Events	4 sessions over 2 weeks, 10-15 minutes each	Smarties Self* Smarties Other* Follow-up: Smarties Self* Smarties other* Maxi*
Slaughter & Gopnik (1996) Study 1	N=33 Mean Age: 3:8 11 Belief 11 Coherence 11 Control	Smarties Self Smarties Other Entry Criteria: Failure on both	Belief Group: 2 "representational change" tasks (i.e. soap/ball) Coherence Group: desire task and perception task	One sentence each task Positive /Negative as appropriate	2 sessions over 2 weeks	Smarties Self* Smarties Other*
Study 2	N=39 13 Belief 13 Coherence 13 Control	Smarties Self Smarties Other Entry Criteria: Failure on both	As above	As above	As above	As above* Follow up Appearance-reality*, Speaker certainty*, Knowledge Sources*
Slaughter (1998)	N=30 Mean Age: 3:10 10 "Belief" 10 "False Picture" 10 Control	Smarties Self Smarties Other Entry Criteria: Failure on both	Belief Group: as above False Picture Group: 2 "photo change" tasks	As above	2 sessions over 2-3 weeks, 10 minutes each	Smarties Self* Smarties Other* Appearance-reality* Perspective taking* False Photo, False Picture
McGregor et al. (1998)	N=32 Mean Age: 3:3 16 Trained 16 Control	Smarties Maxi Deception Task Entry Criteria: Failure on 2/3	Up to 2 types of doll enacted Maxi tasks (standard and "picture in hand")	Errorless Learning: Correct false belief based action modelled by protagonist	2-3 sessions over 1 week, 1 hour each	Smarties* Maxi* Real life Maxi* Appearance-reality Windows Task
Swettenham (1996)	N=8 All Trained	1 Maxi 2 Smarties Self 2 Smarties Other Novel false belief behaviour prediction task Entry Criterion: Failure on all tasks	Computer based: Maxi Task, 6 trials/session	Errorless as above	4 days with 2 sessions/day	1 Maxi 2 Smarties Self 2 Smarties Other Novel false belief behaviour prediction 5/5 pass Maxi 5/8 pass at least one transfer task follow-up as above

* Training group significantly outperformed control group

In contrast to the successful training studies, the inclusion criteria adopted by the unsuccessful training studies have generally been less stringent. For example, Flavell et al. (1981) and Flavell et al. (1986) included those children who at the time of pre-testing scored poorly on Level-2 visual perspective taking or appearance-reality tasks, although failure on all training relevant tasks was not a prerequisite for selection. It is therefore possible that the less stringent entry criteria adopted by these training studies influenced the potential training effects. In showing some, although very little, understanding of the trained concept at the time of pre-testing, the children in these studies may have already possessed a crucial aspect of the target concept, so that the training could have had little impact on their already existing abilities. The inclusion of some children with knowledge of the training concept may thus have masked the potential facilitative effects of the training for children showing no understanding of the concept at the time of pre-testing.

2.0.iii.c Training Scheme and Intensity

The nature of the training procedure itself is possibly one of the most crucial aspects of a training scheme methodology. The ideal teaching method will present the relevant information in such a way as to maximise the learning potential of the individuals. It is known from other developmental arenas and from research within educational psychology that teaching methods greatly influence how quickly and how well children come to learn new material (Schmeeck, 1988). The five successful training studies demonstrate that there is more than one way to teach false belief understanding to young children effectively (See *Table 2.1* for summary).

Swettenham (1996) and McGregor et al. (1998) both utilised errorless false belief training techniques. The Swettenham (1996) study involved an intensive, computer-based training regime whereby the events of two unexpected transfer Maxi false belief scenarios unfolded on the computer screen, complete with experimenter

read text narration of the events. Prompts indicating the critical events of the scenarios were also included (e.g. “Sally will think that her ball is still in the red/blue box”, Swettenham, 1996, p159). The children were asked to predict the false belief based location search of the story protagonist. Although positive feedback was provided for correct responding, in the case of incorrect responding, the protagonist expressed her thoughts about the location of the object (e.g. “I think the ball is in the red/blue box where I left it.” Swettenham, 1996, p159) and the child was asked to try again. After three incorrect responses, the child was prompted to the correct location.

McGregor et al. (1998) adopted a similar errorless learning training method consisting of three stages. In this procedure, doll-enacted unexpected transfer Maxi false belief task scenarios were presented. In the initial stage of the training, the protagonist’s intention to leave his object and to have it stay in a particular location was highlighted. The children were asked to predict the false belief based search location of the protagonist. If the children showed difficulty with this task they were introduced to a second type of doll-enacted transfer scenario. This portion used the “picture-in-head” technique whereby a picture representing the protagonist’s thoughts was inserted in the doll’s head as a training cue (Swettenhan et al., 1996). In the third stage of the training, the picture-in-head cues were gradually reduced until the pictures were no longer used. Positive feedback was provided in the event of correct responding and for incorrect responses the protagonist expressed his thoughts and went on to act according to his false belief.

Appleton and Reddy (1996) adopted a discussion session method of teaching false belief. Children were encouraged to participate in experimenter-led discussions relating to the events depicted in various video recordings of unexpected transfer Maxi false belief scenarios. Memory and explanation questions addressing the events leading up the protagonist’s false belief about the location of the displaced object

were addressed in the discussion sessions, in an attempt to encourage the children to appreciate how physical events transpiring in the scenes influenced the thoughts and seemingly inappropriate actions of the protagonist.

In the Slaughter and Gopnik (1996) study, a very different teaching method was adopted. Children were trained about the concepts of false beliefs for the belief training group, or desires and perceptions for the coherence training group, by providing them with exposure to appropriate feedback to their responses on false belief or desire and perception tasks. In each training session children were trained on one trial in which they were asked to recall their earlier false belief or desire/visual perception and to predict the current false belief or desire/perception of a protagonist. Children were appropriately reinforced for correct responses during the training trials, and in the case of incorrect responding, counter-evidence was provided. Slaughter (1998) adopted a very similar training regime, whereby groups were trained via this method of single trial sessions with appropriate counter-evidence feedback on false belief for the belief training group or false photograph tasks for the false photo group.

Similar training schemes have, however, proved ineffective in inducing sufficient improvements. In Flavell et al.'s (1981) Level-2 visual perspective taking and Flavell et al.'s (1986) and Taylor and Hort's (1990) appearance-reality training schemes children were provided with appropriate feedback to responses on various task trials but no robust post-test concept generalisation was observed. A possible explanation for the lack of training effects found in the Level-2 visual perspective taking and appearance-reality studies versus the successful findings of the two similar false belief studies, despite adopting the same training method, may be due to differences in the training intensity. "Intensity" of training refers to the number and timing of the training sessions. Slaughter and Gopnik (1996) and Slaughter (1998) allowed two weeks between their pre- and post-testing sessions with a total of two

training sessions falling in-between the two testing dates. Similarly, Appleton and Reddy (1996) allowed two to three weeks between pre-testing and post-testing, interrupted by a total of four training sessions. McGregor et al.'s (1998) training scheme also spanned between two to three one hour sessions over the course of one week and Swettenham (1996) extended his training scheme over four days, completing two sessions of six training trials each per day. Flavell et al. (1981), Flavell et al. (1986) and Taylor and Hort (1990) pre-tested, trained, and post-tested their subjects during the same sitting. It is possible that one training session was not sufficient for bolstering understanding, or that the post-testing was administered too closely to the training session in such a way that sufficient time was not permitted to incorporate the newly learned knowledge into existing schemas.

2.0.iii.d Training Generalisation

A final methodological issue to be considered when interpreting the findings of training studies relates to concept generalisation (See *Table 2.1* for summary of prior training studies). The success of a particular training scheme is marked by generalisation of the training concepts to non-training related tasks. Improvements in only training-task related performance would suggest the accumulation of a task-specific strategy for post-test success rather than any genuine increase in conceptual understanding (Swettenham, 1996). To assess adequately whether a training benefit is genuinely understood at a meaningful, conceptual level, tasks of both *close-* and *distant-transfer* are necessary at the time of pre- and post-testing. Close-transfer tasks are tasks that are identical in structure to a trained task. If, for example, individuals were trained on an unexpected transfer Maxi false belief task, a close-transfer task would be another version of the Maxi task. The storyline, protagonists, and the object of transfer may vary from those used in training but the close-transfer task would mirror exactly the format of the trained task. A distant-transfer task is one designed to

assess non-training related concept generalisation and differs in structure from the training tasks. If, for example, an unexpected transfer Maxi false belief task was used for training, generalisation of the false belief understanding achieved from the training may be assessed by an alternative false belief task, for example, a deceptive box Smarties false belief task. The use of both close- (training related) and distant-transfer (non-training related) tasks in pre- and post-test assessment is a crucial methodological consideration in training studies. The use of only close-transfer tasks severely limits the interpretative power of a training's potential effectiveness. Success on distant-transfer tasks would demonstrate a true conceptual training benefit as a rote-response strategy learned in training would not be sufficient for generalised task success (Swettenham, 1996).

Prior training studies have used various definitions and methods of assessing generalisation and consequently interpreting the effectiveness of various schemes is somewhat difficult. The unsuccessful training studies observed no significant increases in performance of the trained skills at the time of post-testing and it was therefore concluded that these training schemes were ineffective in facilitating understanding of the relevant concepts. Even if post-test performances had improved from pre-testing, concluding genuine improvement in conceptual understanding would have been questionable because of the lack of distant-transfer pre- and post-test tasks in these studies. In each of the unsuccessful training studies (Flavell et al., 1981; Flavell et al., 1986; Taylor & Hort, 1990), the children were pre- and post-tested on tasks identical in structure to the tasks on which they were trained. It would have been difficult, therefore, to conclude whether the training effect (had there been one) was conceptual or a task-specific artefact.

The successful training studies all assessed non-training related tasks designed to measure the potential of concept generalisation. Appleton and Reddy (1996), while

pre- and post-testing and training their children on unexpected transfer Maxi tasks, pre- and post-tested the children on the deceptive box Smarties task “self” and “other” questions. Performance of the training group improved significantly on all of these false belief test questions, suggesting that the training scheme provided the children with knowledge generalisable to other false belief tasks. In a follow up post-test two to three weeks later, the trained children had retained this generalised knowledge. This was demonstrated by their outperforming the control group on the deceptive box Smarties false belief tests, as well as outperforming the control group on the trained task. Children in the Swettenham (1996) study were pre-tested on a battery of close- and distant-transfer tasks. While trained on the unexpected transfer Maxi false belief task, pre- and post-test data was collected on one close-transfer Maxi task, two versions of the “self” and “other” deceptive box Smarties false belief task as well as a novel false belief behaviour prediction task. At post-testing and at three-month follow-up, all children showed success on the trained task and five of the eight children showed at least some generalisation by responding correctly on at least one of the distant-transfer tasks.

All children in the training group of *Study 1* in the Slaughter and Gopnik (1996) study were pre- and post-tested on the “self” and “other” versions of the deceptive box Smarties false belief task. The children in the “belief” training group were trained on two tasks: the first required the child to report his or her earlier false belief and to predict the false belief of another relating to the identity of a deceptive object (e.g. soap in the shape of a golf ball). Children in the desire and perception or “coherence” training group were asked to report their earlier, but now satiated desire (to eat apple slices). The children were also asked to predict whether another individual (appetite unsatiated) would desire some apple slices. Children in this group were also asked to recall their earlier perception of the colour of a cat, which

from their earlier visual perspective (through a coloured filter) appeared black, but which from their current perspective on the other side of the filter appears green. The children were also asked to predict what another would think the colour of the cat would be from the perspective view through the green filter. Children in both training groups (belief and coherence) were shown to outperform the respective control group on the deceptive box Smarties false belief test questions, suggesting a generalisable training effect for both groups.

In Slaughter and Gopnik's (1996) *Study 2*, children were trained as above and were pre- and post-tested on versions of the deceptive box Smarties task and were post- but not pre-tested on the distant-transfer appearance-reality (Flavell et al., 1996), speaker certainty of mental states (Moore, Bryant & Furrow, 1989) and sources-of-knowledge tasks (O'Neill & Gopnik, 1991). Children in the training groups were shown to outperform a control group on these tasks; however, because of the lack of pre-test data for many of the distant-transfer tasks it is difficult to conclude whether true generalisation of this material actually occurred.

Slaughter (1998) pre- and post-tested on the identical deceptive box Smarties false belief tasks as used in the Slaughter and Gopnik (1996) study. Slaughter (1998) also adopted the same belief training procedure as used in the Slaughter and Gopnik (1996) study. Slaughter (1998) incorporated another training scheme similar in structure to the belief training to train false photograph understanding to a second group of children (Leekam & Perner, 1991; Leslie & Thaiss, 1992). The children in all groups were post-tested on versions of the false photograph task (Leekam & Perner, 1991; Leslie & Thaiss, 1992) and false picture tasks (Charman & Baron-Cohen, 1992). The children were post- *but not* pre-tested on an appearance-reality task (Flavell et al., 1986) and a visual perspective taking task. Children in the false belief group outperformed the control and picture groups on false belief, as well as on

appearance-reality and visual perspective taking tasks. As in the Slaughter and Gopnik (1996) study, with no baseline understanding of these concepts recorded prior to the training implementation, it is difficult to conclude whether true generalisation actually occurred.

Children in the McGregor et al. (1998) study were pre-and post-tested on a training-related unexpected transfer Maxi false belief task, as well as non-training related deceptive box Smarties false belief and deception tasks (Sodian, 1991). McGregor et al. (1998) post-tested *but not* pre-tested their sample on three distant-transfer tasks: a task of deception, a real life enacted unexpected transfer and an appearance-reality task. Children in the training group significantly out-performed a control group at the time of post-testing on the real life unexpected transfer and Smarties false belief tasks, but not on a task of appearance-reality. Again, the lack of pre-test data for these tasks limits the conclusions that can be drawn from these findings.

2.0.iv Summary

In summary, the findings of various mentalising related training studies have been mixed. It is argued here, however, that methodological issues relating to the deployment of such training schemes may play a significant role in the discrepancies in the findings obtained to date. That is, while the Level-2 visual perspective taking and appearance-reality training studies have thus far proved ineffective, it may not be the case that such abilities cannot successfully be trained; rather, the method of training may be central to the effectiveness of training. The findings of the five successful false belief training studies provide strong evidence to suggest that false belief and other related mentalising skills may be successfully taught to young children.

2.0.v Aims

The present study was designed to replicate the successful false belief training effects with young children while addressing some of the key methodological issues presented above. An intensive training regime was devised incorporating a combination of methods used in successful false belief training studies reported in the literature. The training and testing phases, spanning over the course of two weeks, were designed to allow time for possible dynamic conceptual changes to occur. It was predicted that, in line with previous studies, the children exposed to the false belief training scheme would show an increase in false belief understanding in relation to the control group, as assessed by pre-test and post-test performance comparisons. This study differs crucially from many previous training studies. As in the Swettenham (1996) study, a stringent entry criterion was adopted in order to clarify the children's baseline false belief understanding. Only those children demonstrating no standard laboratory-assessed false belief understanding participated in the study. That is, only children who at the time of pre-testing failed all three test questions from two different false belief paradigms were included: both the "self" and "other" questions of the deceptive box Smarties task and the unexpected transfer Maxi test question. To date, the literature has seen only limited discussion of what it may mean when children show success on some but not all of the standard task questions, and consistency across different mentalising tasks has been shown to be moderate at best (Charman & Campbell, 1997; Cicchetti & Cohen, 1995; Mayes, Klin, Tercyak, & Cohen, 1996). Therefore, it is possible that in the Slaughter (1998), Slaughter and Gopnik (1996), and Appleton and Reddy (1996) studies, some of the children failing both "self" and "other" questions on the pre-test deceptive box Smarties false belief task, may have passed (for instance) an unexpected transfer Maxi false belief task had they been given one. In this study an entry criterion of failure on all three test questions across the two tasks was aimed to ensure that, at pre-test, children's

understanding of false belief was not at the level sufficient to demonstrate first-order false belief understanding, as measured by both of the standard tasks.

2.1 Method

2.1.i Design

A conventional pre-test, post-test design was adopted. The children were pre- and post-tested on one unexpected transfer Maxi task (Wimmer & Perner, 1983) and on both “self” and “other” attributions of the deceptive box Smarties task (Perner et al., 1987). The scores on three false belief post-tests were the dependent variables. Group assignment (training or control) was the independent variable. The treatment and control sessions began within one to five days following the pre-test assessment. Both training and control groups received three contact sessions over the course of a two week period. All children were reassessed on the initial measures between one and five days following the last contact session. All but three children (two from the control group and one from the training group) were post-tested two days following the final contact session. The remaining three children were tested on the fifth day following the final session.

The control sessions consisted of 10 to 15 minutes of story reading by the experimenter. Each 10 to 15 minute training session was divided into two sections. For one half of each training session the children were encouraged to reflect on and *explain* the events of various false belief scenarios. In the other half of sessions, the children were asked to *predict* the false belief based behaviour of protagonists in false belief scenarios. Feedback given by the experimenter varied between the two training sections in an attempt to intensify the possible facilitative effects of the training. In the *explanation* section, the experimenter corrected children’s incorrect responses and the crucial events of the story were reiterated. In the *prediction* section, incorrect

responses resulted in the protagonist-doll correctly acting on his or her false belief with his confusion relating to his or her belief highlighted.

It was hypothesised that children in the training group would increase in performance from the time of pre-testing to post-testing on all false belief measures.

2.1.ii Participants

Participants for this study were recruited from three preschools and nursery centres in London. All participants were native speakers of English as indicated by parental report. The children were of mixed ethnicity, with approximately 50 percent Caucasian and 50 percent from ethnic minority groups. For all pre-tests the children were required to pass specific control questions to ensure they understood the nature of the stories and concepts pertaining to the test questions; failure on any of the control questions resulted in exclusion from the study⁸ (See *Appendix I* for scripts). Children were excluded from this study if success was demonstrated on any of the three false belief pre-test measures; 22 of 46 children pre-tested qualified for inclusion. There were 11 children (4 boys, 7 girls) in the training group and 11 children (5 boys, 6 girls) in the control group. Group assignment (training or control) was age-matched. The mean age of children assigned to the false belief training group was 3:4 (years: months), standard deviation 4:1 months, range 2:11 to 4:0. The mean age of children assigned to the control group was 3:5, standard deviation 3:7 months, range 3:0 to 4:2. An independent samples t-test showed that the two groups did not significantly differ in age, ($p > 0.1$, two-tailed).

2.1.iii Materials

For each of the three types of false belief tasks, two sets of materials were used: one set for pre-testing and the other for post-testing. For the deceptive box Smarties false belief tasks a Smarties tube filled with coins, a plasters box filled with

⁸Note that this criterion applied also to post-testing, at which time all children were successful.

birthday cake candles and two fluffy toys were used. For the unexpected transfer Maxi tasks (Wimmer & Perner, 1983), four small, differently coloured boxes, four small dolls, one ten pence coin and one marble were used.

A third set of false belief materials was used for the training procedure. The *explanation* section of the training utilised four unexpected transfer Maxi type false belief cartoon scenes; each scenario consisted of four to five A-4 sized frames. For the *prediction* section of the training three, small dolls, one fluffy puppy doll, two differently coloured two centimetre boxes, one seven centimetre doghouse and one ten centimetre house were used.

2.1.iv Procedure

2.1.iv.a Pre- and Post-testing

For the pre- and post-testing sessions the children were invited to play some games with the experimenter. All children were tested individually in a private room of the nursery. The experimenter and the child sat opposite and facing each other at a small table. The order of presentation of the two sets of materials was counterbalanced for pre- and post-testing. That is, one half of the sample was pre-tested on one set but post-tested on the second set; the set presentation was reversed for the other half of the sample. The order of presentation of the unexpected transfer Maxi task and the deceptive box Smarties tasks (“self” and “other” versions) was counterbalanced between children so that one half of the sample was tested on the Maxi task first and the other half was tested on the Smarties task first.

Standard unexpected transfer Maxi task procedures modelled after the Wimmer and Perner (1983) original study were utilised (See *Appendix 1* for scripts). In these tasks, a protagonist comes to hold a false belief about the location of an object, which was displaced in his or her absence. Upon his or her return, the child was asked to report the protagonist’s current belief about the location of the object.

Standard procedures for the “self” and “other” attributions for the deceptive box Smarties task (Perner et al., 1987) were adopted (See *Appendix 1* for scripts). For this task, the child was shown a familiar container that was opened to reveal unexpected contents. For the “self” attribution, the child was asked to recall his or her initial false belief pertaining to the box contents. For the “other” attribution, the child was to predict the initial false belief about the contents of the box of a protagonist.

2.1.iv.b Training Scheme

This investigation differs from prior training studies in relation to the training setting. Unlike the one-to-one training schemes used in earlier studies, the training was administered within a group setting of three to four children. The group setting was considered a more naturalistic teaching environment, more closely modelling preschool experiences of learning. Furthermore, when exposed to the feedback provided to other children, the participants would experience (both directly and indirectly) more opportunities to observe and experience the training information than may be provided in brief one-to-one encounters. The group dynamic of the training sessions was therefore expected to facilitate the learning process of the relevant concepts.

In both the *explanation* and *prediction* sections of the training procedure, children were exposed to the events of different versions of the unexpected transfer Maxi false belief scenario (Wimmer & Perner, 1983). The sessions were divided into two training sections: one half focused on false belief *prediction* and the other focused on false belief *explanation*. The *explanation* portion of the training was based on the training procedures devised by Appleton and Reddy (1996). For this part of the training, the children were introduced in total to four cartoon false belief scenarios over the course of the three training sessions: two of the scenarios were covered in the first training session and the remaining two scenarios were covered in second training

session. All four scenarios were reviewed in the final training session. *Figure 2.1* shows an example training scenario from the *explanation* portion of the training (See *Appendix II* for remaining scenes). Following the presentation of each of the training false belief scenarios, the experimenter led a discussion of the events depicted in each story (See *Table 2.2* for script). The discussion provided a series of questions relating to the physical events that had transpired, leading up to the protagonist's false belief about the current state of affairs and his or her mistaken search for an object that was displaced in his or her absence. The discussion questions were designed to encourage the children to consider and to explain the sequence of events that contributed to the false belief, and to consider what consequences outdated beliefs have on behaviour.

The false belief *prediction* portion of the training scheme was based on the procedures of McGregor et al. (1998). In this section of the training, the experimenter using three-dimensional dolls enacted the false belief scenarios. The focus of this section of the training was on the prediction of the mistaken behaviour as based on a protagonist's false belief about the location of a displaced object. In the first training session, the first of two doll-enacted false belief prediction scenarios was presented and the other was presented in the second session. The order of presentation of the two scenes was counterbalanced. In the third training session, both prediction scenarios were reviewed. *Table 2.3* displays an example training scenario from this portion of the training (See *Appendix III* for remaining script). In both of these scenarios, the children were led through the events of the object location change up to the return of the protagonist. Through to this critical stage, the protagonist's intention to keep the object safe in the initial location was highlighted in an attempt to focus the children on physical events that contributed to the false belief. The children were then asked to predict where the protagonist would look for the object. As in the *explanation* section of the training, following the presentation of the prediction

scenarios, the children participated in an experimenter led discussion of the events depicted in the scene. The memory and explanation questions for these training scenarios were adapted to the prediction scenarios but were otherwise identical to those used in the *explanation* training (See *Table 2.2* for script).

Table 2.2: Example memory and explanation discussion questions for the false belief explanation section of the training scheme (corresponding scenario displayed in Figure 2.1).

<u>Memory Questions</u>
<i>"Where did Bobby put the chocolate at the beginning of the story?"</i>
<u>Feedback Correct Response:</u> <i>"That's right. Bobby left the chocolate in the kitchen drawer at the beginning of the story."</i>
<u>Feedback Incorrect Response:</u> (Experimenter points to Frame 2). <i>"No, remember how Bobby carefully placed his chocolate in the kitchen drawer."</i>
<i>"Where did Mummy move the chocolate to?"</i>
<u>Feedback Correct Response:</u> <i>"That's right. Mummy moved the chocolate to the cupboard."</i>
<u>Feedback Incorrect Response:</u> (Experimenter points to Frame 4). <i>"No, remember how Mummy moved the chocolate to the cupboard."</i>
<i>"Did Bobby see Mummy move the chocolate to the cupboard?"</i>
<u>Feedback Correct Response:</u> <i>"That's right. Bobby did not see Mummy move the chocolate because he was outside playing."</i>
<u>Feedback Incorrect Response:</u> (Experimenter points to Frame 3). <i>"No, remember Bobby did not see Mummy move the chocolate because he was outside playing."</i>
<i>"Where did Bobby look for his chocolate bar?"</i>
<u>Feedback Correct Response:</u> <i>"That's right. Bobby looked in the kitchen drawer for his chocolate."</i>
<u>Feedback Incorrect Response:</u> (Experimenter points to Frame 5). <i>"No, remember Bobby looked in the kitchen drawer for his chocolate."</i>
<u>Explanation Questions</u>
<i>"Why did Bobby look in the kitchen drawer for his chocolate bar?"</i>
<u>Feedback Correct Response:</u> <i>"That's right."</i> (Followed by relevant explanation, e.g. Bobby thought it was in there, Bobby left it in the drawer, etc.)
<u>Feedback Incorrect Response:</u> (Experimenter reviews story highlighting key features, e.g. Bobby did not see Mummy move it so he still thinks it is where he left it, etc.)
<i>"Why did Bobby think the chocolate bar was in the kitchen drawer?"</i>
<u>Feedback Correct Response:</u> <i>"That's right."</i> (Followed by relevant explanation, e.g. that's where Bobby saw his chocolate, he did not know it had been moved out of the drawer, etc.)
<u>Feedback Incorrect Response:</u> (Experimenter reviews story highlighting key features as above).

Figure 2.1: Example training scenario from the false belief *explanation* section of the training scheme.

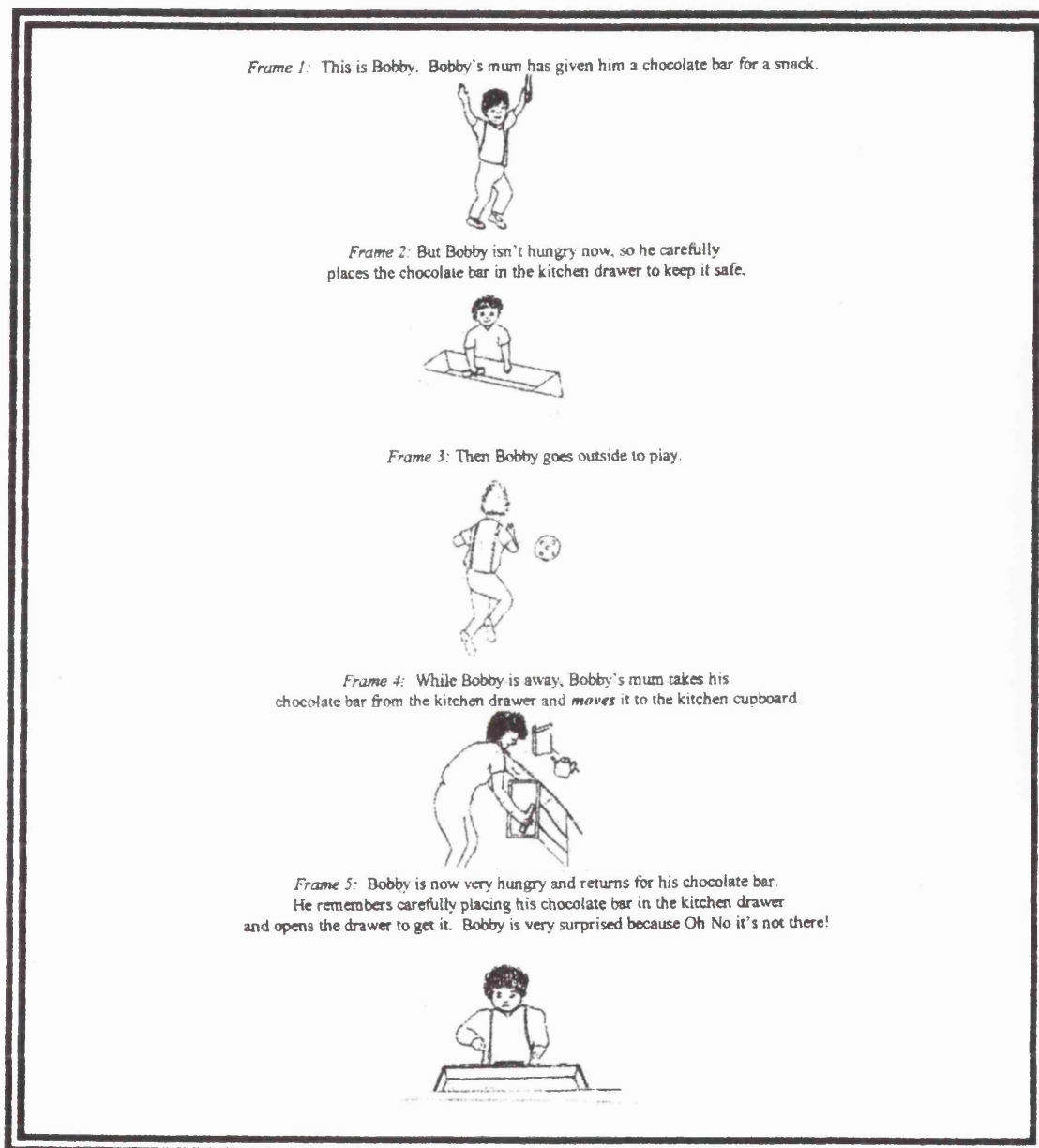


Table 2.3: Example training scenario from the false belief prediction section of the training scheme.

(Child is introduced to doll and fluffy puppy)

"This is Pat and this is Pat's house. This is Pat's puppy. He is in his doghouse."

(Pat doll is made to look in house and then in doghouse)

"Pat is looking for her puppy.

First she looks for her puppy in her house but he's not there.

Next she looks in the doghouse for him. And there he is!

Pat is very happy to have found her puppy.

She tells him to stay in the doghouse while she gets his tea ready."

Memory Question: *"Where does Pat want her puppy to stay while she gets his tea?"*

Feedback as appropriate: *"Yes, that's right." or "No, Pat wants her puppy to stay in his doghouse."*

(Exit Pat doll. Puppy is made to run from doghouse to house)

*"Pat now leaves to fetch Puppy's tea. But look, while Pat is away,
Puppy runs out of his doghouse and into Pat's house."*

Memory Questions: (Feedback as above) *"Where is the puppy?"*

"Where was the puppy at the beginning of the story?"

(Return Pat doll)

"Pat now returns with Puppy's tea."

Explanation Question: *"Where will Pat look first for her puppy?"*

Feedback Correct Response: *"That's right. Pat is very surprised that her puppy is not in his doghouse."*

Feedback Incorrect Response: *"But I remember telling Puppy to stay in his doghouse. Oh, No! My puppy is gone. He has run away."* (Doll is then made to look for the puppy in her house) *"Here is my puppy! He ran away from his doghouse where I left him and went to my house!"*

All of the children were encouraged to participate in the discussion sections in both the *prediction* and *explanation* portions of the training. Some children failed to respond spontaneously to the discussion session questions (often because others had already shouted out answers before their own responses were formulated) and they were called on individually by the experimenter to respond. Each child responded to all the discussion questions at least once per scene. Appropriate feedback was given for all responses; however, the method of feedback differed for the two training sections. In the *explanation* section, incorrect responses were corrected and the critical events of the story were reviewed and highlighted by the experimenter. In the *prediction* section the prediction questions were corrected by the story protagonist who was then made to act on the basis of his or her false belief. The protagonist was made to explain aloud his or her apparently mistaken search for the displaced object, and his or her interpretation of the events and feedback for the discussion questions was as described above.

2.1.iv.c Control Scheme

During each of the control sessions, groups of three to four children participated in a 10 to 15 minute story session whereby the experimenter read storybooks to the children. The stories were pre-screened for mentalising and false belief related concept material to ensure the children were not exposed to training related information during the sessions.

2.2 Results

For each task, the children were scored on a pass/fail criterion according to the accuracy of their responses. Children's responses were scored as fail if they answered incorrectly or inappropriately to any test or control question or if no response was given (e.g. "I don't know").

Table 2.4 shows the number of children passing each of the false belief post-tests. As can be seen from the table, the training and control groups performed similarly on the nontrained distant-transfer deceptive box Smarties “self” and “other” false belief tasks. Very few children from either group demonstrated post-test improvement. On the “self” question, only one child from the training group and three children from the control group showed post-test success. Similarly, just two children in the training and one child from the control group improved on the “other” Smarties false belief question. A between-groups chi-square analysis revealed that the proportions of each group who passed the “self” and “other” test questions did not differ (“self” $X^2(1, N = 22) = 0.31$, ns; “other” $X^2(1, N = 22) = 0.00$). Within-subject McNemar pre-test versus post-test comparison analyses revealed no significant increases in performance from pre-testing to post-testing on the “self” or “other” versions of the deceptive box Smarties false belief test for either the training group (“self” $X^2(1, N = 11) = 0.0$, ns; “other” $X^2(1, N = 11) = 0.50$, ns) or control group (“self” $X^2(1, N = 11) = 1.33$, ns; “other” $X^2(1, N = 11) = 0.0$, ns).

The performances of training and control groups on the trained task, the unexpected transfer Maxi false belief test, demonstrate a very different pattern of results (See *Table 2.4*). Consistent with the poor performances of the two groups on the deceptive box Smarties tests, no children in the control group showed post-test success on the unexpected transfer Maxi false belief task. The training group, however, demonstrated considerable improvement in this task with nine of the eleven children passing. The proportion of children in the training and control groups who passed this task differed significantly, ($X^2(1, N = 22) = 12.0$, $p < 0.001$). A within-subject McNemar pre-test versus post-test comparison analysis confirmed that the training group significantly improved in performance from pre-testing to post-testing on the unexpected transfer Maxi false belief test, ($X^2(1, N = 11) = 7.11$, $p < 0.01$). No

significant pre-test, post-test increase in performance was observed for the control group on the unexpected transfer Maxi task, ($X^2(1, N = 11) = 0.0$, ns).

Table 2.4: Number of children in the false belief training and control groups passing the false belief post-tests.

Group	Deceptive Box Smarties Task		Unexpected Transfer Maxi Task
	<i>Self</i>	<i>Other</i>	
Training Group (n=11)	1 (9.1%)	2 (18.2%)	9 (81.8%)
Control Group (n=11)	3 (27.3%)	1 (9.1%)	0
<i>McNemar Training Group</i>	Both Nonsignificant		$p < 0.01$
<i>McNemar Training Group</i>	Both Nonsignificant		Nonsignificant

2.3 Discussion

This study demonstrated that young children, when exposed to a false belief training regime, show a training task-specific improvement. That is, the only significant pre-test, post-test increase was shown by the false belief training group on the close-transfer Maxi false belief task, the task on which they were trained. Unlike the previous false belief training studies reported in the literature (Appleton & Reddy, 1996; McGregor et al., 1998; Slaughter, 1998; Slaughter & Gopnik, 1996) there was no evidence from this investigation to suggest that the knowledge gained from the false belief training generalised to distant-transfer false belief tasks.

The fact that the post-test false belief improvement of the training group was restricted to a close-transfer training task suggests that the training scheme provided the children with *some* benefit or knowledge necessary to generate increased success. It is unlikely, however, that the learning that occurred incorporated a conceptual

understanding of the nature of beliefs. It appears that children merely learned a rote response strategy for success on the close-transfer task, rather than any form of conceptual understanding that could then be applied to novel distant-transfer false belief tasks. This is an unexpected finding as the training scheme devised for this study incorporated methods from two training studies which have previously demonstrated some success in terms of improved performance on distant-transfer tasks (Appleton & Reddy, 1996; McGregor et al., 1998)⁹.

2.3.i Theoretical Implications

The success of prior training studies has been taken as support for the theory theory's child-as-scientist view of mentalising development (Slaughter & Gopnik, 1996; Slaughter, 1998). The successful training studies reported in the literature suggest that young children, when presented with information relevant to mentalising understanding, show increased performance on a variety of mentalising tasks. The findings of the present study conflict with this interpretation and this evidence. Following the training, children did not show significant generalisation of conceptual knowledge to nontrained tasks. That is, providing children with relevant information to facilitate the child-as-scientist proposed conceptual theory reformation did not serve to increase generalised false belief understanding. These findings suggest that "artificial" experience provided in the training scheme did not facilitate the hypothesised theory reformation. Although the findings of the present study did not show that the training provided any conceptual change in false belief understanding, this does not provide conclusive evidence to refute the child-as-scientist hypothesis.

⁹ The Swettenham (1996) study will not be discussed further in relation to generalisation assessment, as generalisation was not formally presented for typically developing children in this study.

It is possible that the relevant processes of the theory reformation may be triggered over the course of natural development.

The findings of the present study are however, more consistent with Fodor's (1987, 1992) modularity account of mentalising development. According to this view, maturation of the theoretical knowledge system depends on processes outside the representational system, such that new information or mentalising experience may not affect the operational performance of the theoretical system. The implementation of a mentalising-based training would be by this view, considered an ineffective means for improving mentalising performance. Although the unsuccessful training effects observed in the present experiment do not reveal whether or not the system of mentalising is in fact modular, the findings are consistent with the notion that mentalising abilities are not influenced by outside experience or exposure as proposed by the modular theory account of development.

2.3.ii Methodological Considerations

It may be useful to investigate the possible effects of some methodological differences between the current and previous studies, which may explain the lack of generalisation effects found here and the generalisation effects reported by Appleton and Reddy (1996), McGregor et al. (1998), Slaughter (1998), Slaughter and Gopnik (1996). The first issue relates to the use of close-transfer (training related) pre- and post-test tasks for the assessment of training concept generalisation. In the Slaughter and Gopnik (1996) and Slaughter (1998) studies, the distant-transfer post-test false belief task was a version of the deceptive box Smarties task, more similar in format and structure to their training scheme task, dubbed the "representational change task", than was the case for the deceptive box Smarties distant-transfer and unexpected transfer Maxi training tasks employed in the present study. In the representational change training task, Slaughter and Gopnik (1996) and Slaughter (1998) showed the

child a deceptive object (e.g. soap in the shape of a golf ball) and asked the child to declare what the object was. The child was then given an opportunity to handle the object and discover its true identity; the child was then asked to recall his or her earlier false belief about the identity of the object and to predict the false belief of a protagonist. Appropriate feedback was given accordingly as part of the training procedure. In these studies, so-called generalisation was assessed in part by the deceptive box Smarties task. It is argued that the “representational change” training closely modelled the structure of the deceptive box Smarties task so that the Smarties task may not be considered an adequate test of generalisation for their training schemes. It is therefore possible that the generalisation effects observed by Slaughter and Gopnik (1996), and replicated by Slaughter (1998), were not a result of conceptual benefit provided by the training; rather, they may have been attributable to the use of a rote strategy arising from exposure to a training task of similar structure. Thus, the lack of distant-transfer generalisation in the present study may not contradict these findings. In Slaughter and Gopnik’s (1996) *Study 2*, training generalisation was also assessed using other mentalising tasks, however, no pre-test data was collected for these tasks; and therefore we do not know whether the children would have passed these tasks at the time of pre-testing.

Similarly, close inspection of McGregor et al.’s (1998) apparent generalisation assessments shows that one of two tasks in which children’s performance “generalised” (out of a total of five potential generalisation tasks) was a task which also mirrored closely the structure and formation of the trained task. This task was, in effect, an unexpected transfer Maxi false belief task, but with the variation of a real-life enactment of the scenario by the experimenter, rather than the traditional doll enactment. Thus, it is argued that this task should be considered a close-transfer

assessment, and again, the findings of the present experiment may not be in direct conflict with the previous finding.

Sampling procedure was a second respect in which the present study differed from prior training studies. The present study was designed with an entry criterion even more stringent than in the Slaughter and Gopnik (1996), Slaughter (1998) and Appleton and Reddy (1996) studies. Only those children demonstrating *no* standard laboratory assessed false belief understanding were included. Recent evidence suggests that young children's scores across standard false belief paradigms may be variable, such that it is not uncommon for children to pass one task but fail another on the same testing occasion (Holmes, Black & Miller, 1996; Miller, Holmes, Gitten and Danbury, 1997). It is therefore unclear whether some of the children in the Slaughter (1998; Slaughter & Gopnik, 1996) and Appleton and Reddy (1996) studies who failed both "self" and "other" questions on the pre-test deceptive box Smarties false belief tasks, may have passed (for instance) an unexpected transfer Maxi false belief task had they been given one. Similarly, Mayes et al. (1996) found that children's scores on false belief tasks were variable between separate testing occasions a few weeks apart. These findings highlight the importance of using more than one false belief task as the basis for the entry criterion in mentalising training studies. It is possible, therefore, that at least some of the children in the Slaughter (1998), Slaughter and Gopnik (1996) and Appleton and Reddy (1996) studies might have demonstrated some false belief understanding at pre-training by passing an unexpected transfer Maxi false belief task, which they were not tested on. Although there is not a clear understanding of what it means for children to show a "partial" or an intermediate grasp of mentalising, it may be that children demonstrating partial understanding of the concept may experience more benefit from the training schemes than children with no false belief understanding. McGregor et al. (1998) used three tasks in their

inclusion procedure. The children who failed two out of three false belief pre-tests, however, were included. A child may therefore have had some false belief understanding at the time of pre-testing. With this entry criterion, it is possible for a child to have passed one of the so-called transfer tasks prior to the implementation of the intervention and boosted the apparent effects of the training task by showing success at the time of post-testing as well. Moreover, it is possible that a child passed the training related task at the time of pre-testing; he or she would not be expected to benefit from training on a skill of which he or she had already acquired.

Alternatively, the present study may have failed to replicate the successful generalisation of prior training studies because of a possible methodological flaw in the training procedures. Such a flaw cannot be ruled out, but is unlikely: the post-training improvement in close-transfer task performance demonstrates that the children were learning something from the training sessions, indicating that the training scheme was at least holding their attention and providing them with some benefit.

2.3.ii.a Experiment Two: A Replication Proposal

Because the findings of the present study conflict with those of prior training studies, Experiment 2 was designed as a replication and extension of the present study. While prior training studies have been successful in training false belief understanding to children, it is possible that the training effects observed to date may have resulted from methodological artefacts, rather than any form of conceptual improvement in false belief understanding. In the present study, procedures shown to have been successful in prior training studies were used in conjunction with stringent controls on baseline mentalising performance and pure distant-transfer tasks for generalisation assessment. If the lack of a training effect observed in Experiment 1 is

replicated in Experiment 2, this will constitute further evidence for this interpretation of the findings of prior training studies.

CHAPTER THREE

Experiment Two

Teaching False Belief and Level-2 Visual Perspective

Taking Skills to Young Children:

Can Mentalising Understanding be Trained?

3.0 Introduction

Recent studies using training scheme methodologies have shown that young children participating in false belief related training may demonstrate significant improvements in false belief understanding which may generalise to nontrained false belief tasks (Appleton & Reddy, 1996; McGregor et al., 1998; Slaughter, 1998; Slaughter & Gopnik, 1996). The primary aim of Experiment 1 was to replicate the successful false belief training effect as reported in the literature, thereby reassessing the theory reformation hypothesis of the child-as-scientist theory view of mentalising development. The child-as-scientist view proposes that children acquire information through exposure to relevant false belief information via experience. By this view, participation in a false belief training scheme should provide new information sufficient to induce the overwriting of primitive knowledge systems, replacing them with more accurate theories of false belief understanding. Contrary to this prediction of the child-as-scientist-view and the findings of prior successful false belief training studies, the training scheme procedure adopted in Experiment 1 did not result in a robust, generalisable post-test improvement in false belief understanding. While the false belief trained children significantly improved on a close-transfer task that was identical in structure to the trained false belief task, this effect did not generalise to nontrained distant-transfer false belief tasks. This finding suggests that

the training scheme provided the children with a task specific rote-strategy for success, rather than any conceptual shift in mentalising understanding or abilities.

This failure to replicate the successful training effect was an unexpected result, particularly as the training procedures utilised in Experiment 1 were based on the procedures of prior successful training studies. It was predicted that the combination of prior false belief training methods would serve to induce a more intensive “double” training effect. It was argued in chapter 2 that the prior training findings may have been confounded by possible methodological artefacts pertaining to sampling and generalisation assessment. Failure to replicate the training effect using stricter sampling and generalisation procedures may suggest that such concepts are not as readily trainable as prior studies may indicate. In light of the failure to replicate the successful generalisation findings of prior false belief training studies, the present chapter was designed to address further the methodological issues pertaining to the use of training schemes. The false belief training regime adopted in this chapter was similar to the procedure used in Experiment 1. As before the false belief training scheme consisted of a combination of methods used in prior successful training studies as reported in the literature. As in Experiment 1, the present study differed crucially from prior training studies with the use of more stringent entry criteria as based on pre-test false belief performance. Only those children demonstrating no baseline false belief understanding, operationalised as failure on all three false belief test questions of the unexpected transfer Maxi test and the “self” and “other” versions of the deceptive box Smarties task paradigms, qualified for inclusion. As before a more naturalistic, group-based teaching environment versus the one-to-one training procedure of prior studies was used in training.

A secondary aim of the study described in this chapter was to investigate the child-as-scientist “conceptual coherence” hypothesis by assessing generalisation more

thoroughly than it was assessed in Experiment 1, with the addition of non-false belief mentalising pre- and post-tasks. By the conceptual coherence account, mentalising understanding throughout development is consolidated within a set of domain-specific concepts so that when new knowledge pertaining to a concept within the domain is acquired it may influence the understanding of other concepts within the domain as a function of their interdependence (Slaughter & Gopnik, 1996; Wellman, 1990).

Evidence in support for the conceptual coherence view comes from the findings of Slaughter and Gopnik's (1996) training study. Along with a group of children trained on false belief tasks, a second group of children in their study, the "coherence group", was trained on tasks of desire and visual perception (but not false belief). This training involved reporting an earlier but now satiated desire to eat apple slices and to predict the desire to eat apple slices of an individual who had not yet eaten any. This group was also asked to recall their earlier visual perception of a toy cat's colour as viewed through a coloured filter, and to predict what colour another individual would judge the cat to be as he or she (but not the child) viewed it through the coloured filter. This non-false belief training group's false belief performance at the time of post-testing was significantly higher than that of a nontrained control group. Like the children trained specifically on false belief understanding, the coherence group children showed generalisable training effects to false belief understanding. In a second follow-up study, Slaughter and Gopnik (1996, *Study 2*) found further crossover effects in that both groups of trained children (false belief and coherence) were shown to outperform a control group on nontrained mentalising tasks of appearance-reality (Flavell et al., 1986), speaker certainty (Moore et al., 1989) and the sources-of-knowledge task (O'Neill & Gopnik, 1991), as well as false belief tasks. These training crossover effects observed by Slaughter and Gopnik (1996) support the

conceptual coherence notion of mentalising in that training children one aspect of mentalising generalised to the understanding of other mentalising concepts.

A possible explanation for the lack of false belief training success in Experiment 1 may be due to the fact that *only* false belief generalisation was assessed. It is possible that training the children on false belief may have boosted their performance on other mentalising tasks had they been tested on them. For this reason, additional generalisation tasks and a second non-false belief mentalising training group was included in the present study, a Level-2 visual perspective taking training group. If children trained on visual perspective training demonstrated improvement in false belief understanding, evidence would be shown in support for the notion that mentalising concepts may be successfully trained and generalised in young children. If, however, only visual perspective taking training task specific improvement was observed, with no “knock on” improvement in false belief understanding (as observed for the false belief training in Experiment 1), further evidence would be provided suggesting children cannot be successfully trained in this manner to appreciate mental state concepts.

3.0.i Aims

The primary aim of the present study was to replicate and extend the findings of Experiment 1. In addition to the false belief training group a Level-2 visual perspective taking training group was added. In order to adequately assess the impact of the Level-2 visual perspective training, three additional Level-2 visual perspective taking tasks (which would act as close- and distant-transfer tasks) were added to the pre- and post-test battery of measures.

The secondary aim of this study was to investigate whether training children on Level-2 visual perspective taking skills might bolster false belief understanding and/or vice versa. That is, does training on false belief understanding generalise to

Level-2 visual perspective taking and does training on Level-2 visual perspective taking bolster false belief performance? If training children on mentalising concepts served to facilitate general performance as assessed by increased performance on distant-transfer tasks, support would be shown for the theory reformation hypothesis as proposed by the child-as-scientist theory account. That is, if false belief training served to facilitate non-training related false belief performance or if Level-2 visual perspective taking training facilitated nontrained Level-2 performance then support would be found for the idea that children may be successfully trained. Moreover, if training children on false belief and Level-2 visual perspective taking served to facilitate generalised mentalising development performance outside of the trained domain, then support would be shown for the child-as-scientist conceptual coherence hypothesis.

3.1 Method

3.1.i Design

A conventional pre-test, post-test experimental design very similar to that adopted in Experiment 1 was utilised. In addition to the unexpected transfer Maxi (Wimmer & Perner, 1983), and the “self” and “other” deceptive box Smarties (Perner et al., 1987) false belief tasks, three Level-2 visual perspective taking tasks were added to the pre- and post-test battery of tests. Two of these Level-2 tasks were used for close-transfer Level-2 visual perspective taking training assessment and the third Level-2 task was used to measure distant-transfer training generalisation. The close-transfer Level-2 tasks were based on versions of Hughes and Donaldson’s (1979) “Level-2 policeman task” and Flavell et al.’s (1981) “standard Level-2 task”. The distant-transfer task, “rotation task”, was based on the procedure developed by Masangkay, Mcliskey, McIntyre, Sims-Knight, Vaughn and Flavell (1974).

The control group received two 10 to 15 minute sessions of non-training related story reading by the experimenter. The false belief training procedure was the same as in Experiment 1, with each false belief training session divided into two sections: *explanation* and *prediction*. The Level-2 visual perspective training involved an interactive learning experience whereby the experimenter explained Level-2 visual perspective taking principles and the children were asked to make various attributions. Feedback was given as appropriate, and as part of the feedback procedure for incorrect responses, the children were encouraged to experience physically the viewpoints at alternative visual perspectives.

The scores on the three false belief post-tests and three visual perspective taking post-tests were the dependent variables. Group assignment (false belief training, Level-2 visual perspective taking training or control) was the independent variable. The treatment and control sessions began between one and five days following the pre-test assessment. Over a two week period, all three groups received two contact sessions (rather than three sessions as in Experiment 1). The duration of each contact session was expanded from 10 to 15 minutes as in Experiment 1 to 15 to 20 minutes in duration for the present study. The total amount of contact time, therefore, remained the same in the two studies. As before, the training and control groups were reassessed on the initial measures between one and five days following the final contact session.

3.1.ii Participants

Participants were recruited from five preschools and nursery centres in London. Children were excluded from this study if English was their second language or if success was demonstrated on any of three pre-test false belief questions. The children were of mixed ethnicity with approximately 50 percent Caucasian and 50 percent from ethnic minority groups. For all pre-tasks, the children

were required to pass specific control questions pertaining to the story events to ensure that they understood relevant aspects of the scenarios; failure on any of the control questions resulted in exclusion from the study¹⁰ (See *Appendices I and IV* for scripts). Of the 88 children pre-tested for the study, 44 children qualified for inclusion. There were 15 children (7 boys, 8 girls) in the false belief training group, 13 children (5 boys, 8 girls) in the Level-2 visual perspective taking training group and 16 children (8 boys, 8 girls) in the control group. The mean age of children assigned to the false belief training group was 3:6 (years: months), standard deviation 7.0 months, range 2:5 to 4:5. The mean age of children assigned to the visual perspective training group was 3:8 (years: months), standard deviation 6.1 months, range 2:1 to 4:0, and the mean age of the children assigned to the control group was 3:5, standard deviation 7.0 months, range 2:6 to 4:6. A one-way analysis of variance showed that the three groups did not significantly differ in age, ($p > 0.1$, two-tailed).

3.1.iii Materials

The materials used for the battery of false belief pre- and post-test assessments were the same as those used in Experiment 1 (See *Section 2.1.iii* for description). For the standard Level-2 visual perspective taking task (Flavell et al., 1981), two full size A-4 drawings (one of a worm and the other of a turtle) were utilised. The turtle was drawn laterally across the page so as to appear standing when the picture was viewed right side up. When the drawing was turned upside down, the turtle appeared to be lying on its back. Similarly, the worm was drawn laterally across the page so that when a 2 X 10 centimetre coloured strip of paper was placed directly under the worm it appeared to be lying on the coloured strip. Alternatively, if a second coloured strip was placed over the worm and the drawing of the worm was turned upside down, the

¹⁰Note that this criterion also applied to the post-test scenarios. One child from the false belief training group and three children from the Level-2 visual perspective taking training failed at least one of the false belief post-test control questions. The pre-and post-test data from these children was subsequently eliminated from any analysis.

worm then appeared to be lying on that strip of paper. For the policeman Level-2 task (Hughes & Donaldson, 1979), two small policeman dolls (6 centimetres each), a boy doll (5 centimetres) and two cardboard partitions measuring 20 x 9 centimetres were used. The partitions were cut partially through the centre so that when put together the two partitions formed a three-dimensional cross-shaped divider, used to divide a table into four quadrants. The rotation Level-2 task (Masangkay et al., 1974) utilised two sets of four identical 6 centimetre toys: one set tigers, the other pigs.

The materials for the false belief training were the same as those used in Experiment 1 (See *Section 2.1.iii* for description). For the Level-2 visual perspective training, two sets of cards each with a 16 x 10 centimetre picture of either a beetle or a cow were used. The cow was drawn laterally as to appear to be lying on its stomach and the beetle to be standing on its feet. A cardboard three-dimensional cross-shaped partition was formed from two blue 40 x 18 centimetre sheets. Twelve centimetre fluffy cat and dog toys and a 5 centimetre mouse toy were also used in the Level-2 visual perspective training.

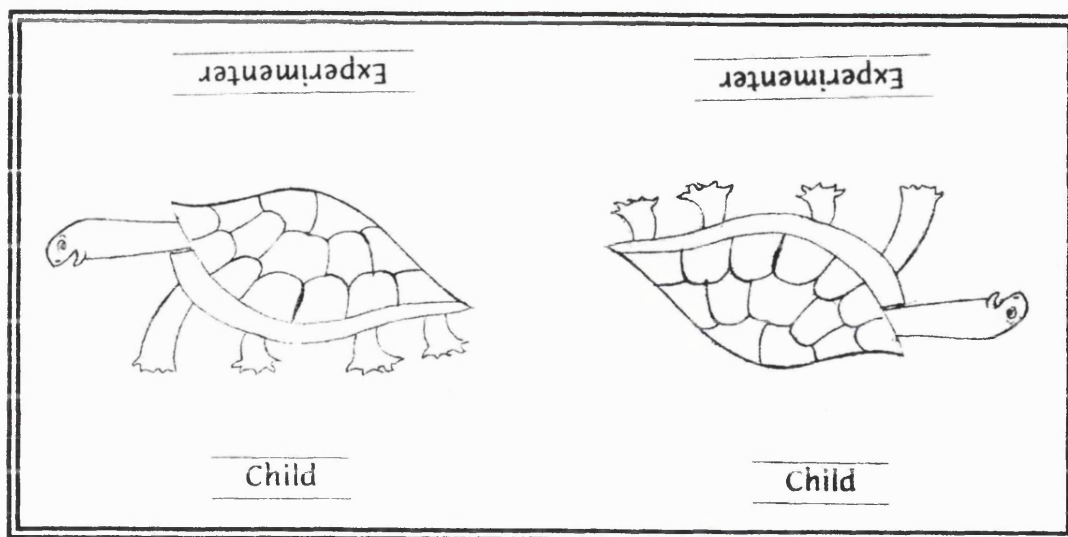
3.1.iv Procedure

3.1.iv.a Pre- and Post-testing Procedures

As in Experiment 1, for the pre- and post-testing sessions the children were individually invited to play some games with the experimenter in a quiet room of the nursery. The procedures for the false belief pre- and post-tests were identical to those of Experiment 1 (See *Section 2.1.iv* for procedures and *Appendix I* for scripts). All children were also pre- and post-tested on three Level-2 visual perspective taking tasks. The presentation order of the three Level-2 tasks was counterbalanced across pre- and post-testing. As in Experiment 1, the children were reassessed on the battery of tests following the final contact session.

The standard Level-2 perspective taking task was modelled after the procedures of Flavell et al. (1981) (See *Appendix IV* for scripts). In one trial of this task, for example, the drawing of the turtle was placed horizontally on the table between the experimenter and the child so that the turtle appeared to be standing on its feet from the child's perspective but lying on its back from the experimenter's viewpoint (*Figure 3.1*). The child was asked to make two "self" and two "other" visual perspective attributions by indicating whether the turtle appeared to be standing on its feet or lying on its back from divergent views. A correct response required acknowledgment of the fact that the child and experimenter had different views and therefore differing interpretations of the situation. The same procedure was repeated using a second set of materials in which the child was asked to make "self" and "other" attributions about the appearance of a worm that appeared to be lying on a red blanket from the child's point of view but appeared to be lying on a blue blanket from the experimenter's perspective.

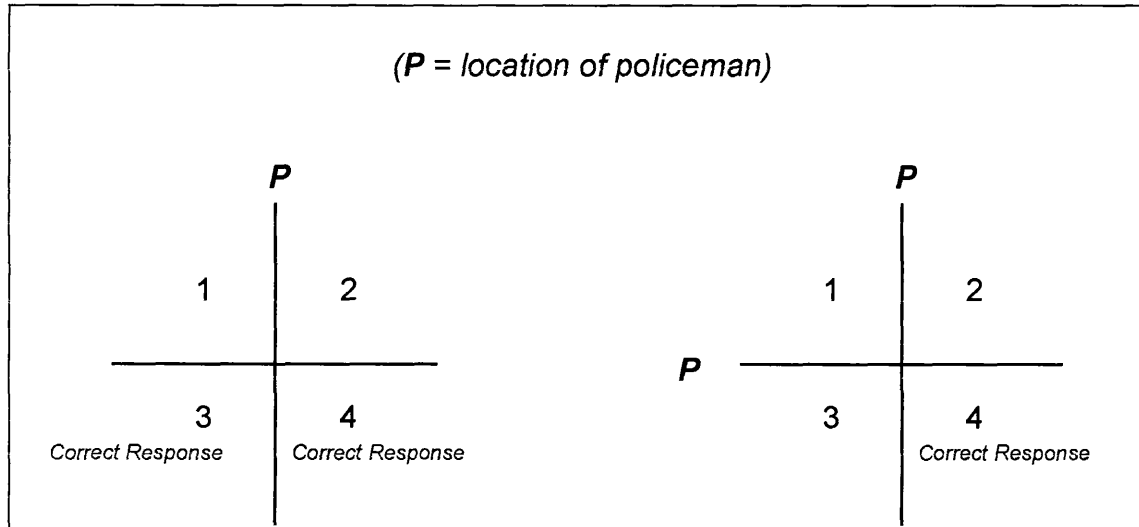
Figure 3.1: Diagram of standard Level-2 visual perspective taking task procedure.



The presentation of material sets was counterbalanced across children so that one half of the children received the turtle set first and the remaining half of the sample received the worm set first. The “self” and “other” attributions were also counterbalanced across trials so that one half of the children were asked to report the “self” attribution first and the other half of the children were asked to make the “other” attribution first.

For the policeman Level-2 task (Hughes & Donaldson, 1979), the child was introduced to a boy doll and policeman doll and it was explained the child's task was to help the boy doll hide from the policeman (See *Appendix IV* for script). *Figure 3.2* displays a model of the cross-shaped, three-dimensional cardboard partition forming four quadrants used for “hiding”. The policeman was positioned at the top of the cross-shaped partition so that he could “see” into the two quadrants that he was directly facing (as denoted by quadrants 1 and 2 in *Figure 3.2*), but not into the two opposing sections (quadrants 3 and 4 as shown in *Figure 3.2*). The child was then asked to hide the doll somewhere within the partition so that the policeman could not see the doll. Success on this task required the child to appreciate that, in order for the doll to be adequately hidden from the policeman’s view, it must be placed in one of the two opposing sections blocked from the policeman’s line of sight (See *Figure 3.2* quadrants 3 and 4). The policeman was then repositioned (facing different two quadrants) and the trial was repeated. Next, a second policeman was introduced and it was explained that both policemen were searching for the doll. The policemen were placed at two adjacent points on the cross-shaped partition leaving only one “safe” quadrant (See *Figure 3.2* quadrant 4). The child was asked to hide the doll from the policemen’s viewpoints; the policemen were then repositioned around the partition for a second trial.

Figure 3.2: Diagrams of Level-2 policeman task materials, based on the diagrams and procedures of Hughes and Donaldson (1979).



The Level-2 rotation task (Masangkay et al., 1974) began with the child and experimenter sitting opposite and facing each other at a table where three identical toys (pigs or tigers) were placed laterally in a line: one with head pointing toward the child, the second with tail end facing the child and head pointing toward experimenter and the third facing sideways (See *Appendix IV* for script). The fourth pig (or tiger), the “target”, was placed slightly to the child's left, away from the other toys and was rotated 0 degrees (facing child), 90 degrees (turned sideways) and 180 degrees (facing experimenter) throughout each trial. It was explained to the child that sometimes the target pig (or tiger) would stand up like each of the other pigs (or tigers). For the “self” trials the child was asked to point to one of the three pigs (or tigers) that appeared to be standing exactly like the target pig (or tiger) from his or her current perspective. For example, if the head of the target pig (0 degree rotation) was facing the child, the correct response would be the pig that is also at a 0 degree rotation. For the “other” attributions the child was asked to report which of the three pigs (or tigers) looked to be standing exactly like the target pig (or tiger) from the experimenter's

visual perspective. A correct response in this case required the appreciation of the fact that the experimenter sitting across from and facing the child would see the tail end and not the head of the pig (or tiger) and therefore the selection of the pig rotated at 180 degrees. The “self” and “other” trials were presented in a counterbalanced order so that one half of the children were presented with the “self” questions first, and the other half were presented with the “other” trials first. One half of the children were pre-tested with the tigers and post-tested with the pigs and this was reversed for the other half of the children.

3.1.iv.b Training Procedures

The false belief training and the control procedures followed those of Experiment 1 (See *Section 2.1.iv.b* for description). The Level-2 visual perspective training procedure comprised two sections. The aim of using two types of procedures was to enhance and amplify any potential benefit received from the training. The order of the two types of training was counterbalanced across training sessions. All of the children were encouraged to participate in all scenarios presented in the training sessions. As in Experiment 1 all children responded to all questions for each type of trial at least once per session. Appropriate feedback was given for all responses. In both portions of the Level-2 visual perspective taking training, incorrect responses were corrected and the child was encouraged to place himself or herself in the relevant physical position to appreciate the view in question.

The first portion of the training, dubbed the *standard Level-2 training*, resembled the format of the standard Level-2 task used in pre- and post-testing and was based on the training procedures developed by Flavell et al. (1981) (See *Table 3.1* for example training script). In this part of the training, the children were invited to sit across from the experimenter and reflect on how the visual perspective of the picture of a cow (or beetle counterbalanced between sessions) varied between the child’s and

experimenter's visual perspective. The children were asked to describe if the cow (or beetle) appeared to be lying on its tummy or on its back from each respective viewpoint. Appropriate feedback was provided and the children were encouraged to investigate physically the views from the divergent positions. All children responded at least once per "self" and "other" questions for each training scenario.

Table 3.1: Example training scenario from the *standard Level-2* section of the visual perspective taking training scheme.

(Children sit opposite and facing the Experimenter on the floor.
A picture of a cow is placed horizontally on the floor between the children and the Experimenter so that it appears to be right side up from the children's viewpoint)

"This is Kathy the Cow.

From where you are sitting, Kathy looks like she is lying on her tummy."

(Experimenter points to cow's tummy).

"But from over here, where I am sitting she looks very different.

From over here Kathy does NOT look like she is lying on her tummy.

To ME, Kathy looks like she is lying on her back."

(Experimenter points to cow's back)

Training Trials: (Cow is placed on floor as described above)

"Does Kathy look like she is lying on her back or on her tummy from where YOU are sitting?"

Feedback as appropriate: (Experimenter points to cow's tummy). *"Yes, that's right."* or *"No, from where you are sitting Kathy looks like she is lying on her tummy."*

"Does Kathy look like she is lying on her back or on her tummy from where I am sitting?"

Feedback as appropriate: (Experimenter points to cow's back). *"Yes, that's right."* or *"No, come over here and have a look."* (Child is encouraged to come over and investigate the Experimenter's view). *"From where I am sitting over here Kathy looks like she is lying on her back."*

(The position of the cow is reversed so that she is lying on her stomach from the Experimenter's viewpoint and lying on her back from the children's perspective and the procedure is repeated)

Table 3.2: Example training scenario from the *Level-2 cat and mouse* section of the Level-2 visual perspective taking training scheme.

(Large three-dimensional cross-shaped partition is placed on table. Children are introduced to fluffy toys.)

"This is Mousy and this is Kitty. Kitty is a nasty cat and she wants to eat poor little Mousy for dinner. Mousy is trying to hide in here."

(Experimenter motions to the cross-shaped partition and the cat is placed at one point of the partition so that she can "see" into two of the quadrants but not into the two opposing quadrants).

Training Trial I: *"Let's help Mousy hide from Kitty. Try to hide Mousy somewhere in here so that Kitty cannot see her."*

Feedback Correct Response: *"Yes, that's right. Kitty can see into here,"*

(Experimenter points to one of the quadrants and cat is made to "see" into the quadrants) *"and she can see into here."* (Experimenter points into the remaining quadrant in view of the cat and cat is also made to look inside) *"But Kitty, cannot see into here, or here."* (Experimenter points to "wall" and cat is made to look at the wall of both partitions)

Feedback Incorrect Response: *"No, let's see. Come over here and have a look."*

(Child is encouraged to come and investigate the cat's view by standing directly behind her and looking into the partition). *"Kitty CAN see in there, so that's not a good hiding place for Mousy."* (Experimenter points into the partition selected incorrectly by the child) *"Try again."*

(The procedure is repeated until correct response is given)

Training Trial II: (Children are introduced to fluffy dog toy). *"This is Doggy. He too wants to eat up Mousy for dinner."* (Cat and dog toys are placed at adjacent points on the partition, leaving only one safe partition for the mouse). *"Let's try to help Mousy hide from nasty Kitty and Doggy. Try to hide Mousy somewhere in here so that both Kitty and Doggy cannot see Mousy."*

Feedback as described above: (Procedure repeated until correct response is given)

The second part of the Level-2 training, the “cat and mouse training”, was designed to model the format of the pre- and post-test policeman task as devised by Hughes and Donaldson (1979) (See *Table 3.2* for script). In this part of the training, the children were introduced to a fluffy toy mouse and it was explained that a nasty cat that wanted to eat the mouse for dinner was chasing the mouse. The children were shown the cross-shaped three-dimensional partition and were asked to help hide the mouse inside the quadrant partitions. The cat was placed at one point of the cross-shaped partition so that she could “see” into two of the quadrants but not the opposing two sections. The children were encouraged to hide the mouse in the “safe” quadrants, so that the mouse could not be seen from the cat’s perspective. As in the *standard Level-2* part of the training, all children participated at least once per scenario. The children were also introduced to a fluffy dog toy and it was explained that it wanted to eat the mouse also. The cat and the dog were placed at various adjacent positions along the partition and the children were instructed to try and hide the mouse from both predators. Again, the children’s responses were appropriately reinforced and, in the case of incorrect responding, the children were encouraged to investigate physically the cat’s visual perspective.

3.2 Results

3.2.i False Belief Performance

Children were scored on a pass/fail criterion for false belief questions according to the accuracy of their responses. Children's responses were scored as fail if incorrect, inappropriate or no response was given for any of the test or control questions (i.e. “I don’t know”).

Table 3.3 shows the number of children passing each of the false belief post-tests. Performance on the “self” and “other” versions of the deceptive box Smarties false belief task was similar across groups. As can be seen in *Table 3.3*, only one

child in the control group and three children each from the false belief training and Level-2 training groups passed the “self” post-test. Similarly, for the “other” deceptive box Smarties post-test question, only one child from the control group and two children each from the false belief and Level-2 training groups were successful. A between-groups chi-square analysis revealed that the proportion of each group who passed the “self” and “other” questions on the deceptive box task did not differ ($\chi^2(2, N = 44) = 1.80, ns$; $\chi^2(2, N = 44) = 2.40, ns$, respectively).

A series of within-subject McNemar pre-test versus post-test comparison analyses revealed no significant increases in performance from pre-testing to post-testing on the “self” (false belief training group, $\chi^2(1, N = 15) = 1.33, ns$; Level-2 visual perspective taking training group, $\chi^2(1, N = 13) = 0.0, ns$; control group, $\chi^2(1, N = 16) = 0.0, ns$) or “other” versions of the deceptive box Smarties task for any of the three groups (false belief training group, $\chi^2(1, N = 15) = 0.50, ns$; Level-2 visual perspective taking training group, $\chi^2(1, N = 13) = 0.50, ns$; control group, $\chi^2(1, N = 16) = 0.0, ns$).

As can be seen in *Table 3.3*, the number of children in the false belief training group passing the unexpected transfer Maxi false belief post-test was considerably greater than the number passing this task in Level-2 visual perspective training and control groups. In the false belief training group 12 out of 15 children passed this task in comparison to only 1 out of 13 and 3 out of 16 in the Level-2 visual perspective training and control groups, respectively. A between-groups chi-square analysis showed that the proportion of children in the false belief training group who passed the unexpected transfer Maxi false belief post-test differed significantly from

the proportion in the visual perspective taking training and control groups ($\chi^2(2, N = 44) = 19.1, p < 0.001$).

Table 3.3: Number of children in the false belief training, Level-2 visual perspective training and control groups passing the false belief post-tests.

Group	Deceptive Box Smarties Task		Unexpected Transfer Maxi Task
	<i>Self</i>	<i>Other</i>	
False Belief Group (n=15)	3 (20%)	2 (26.7%)	12 (80%)
Level-2 Group (n=13)	3 (23.1%)	2 (15.4%)	1 (7.7%)
Control Group (n=16)	1 (6.3%)	1 (6.3%)	3 (18.8%)
<i>McNemar Training Group</i>	<i>both nonsignificant</i>		<i>p < 0.001</i>
<i>McNemar Level-2 Group</i>	<i>both nonsignificant</i>		<i>nonsignificant</i>
<i>McNemar Control Group</i>	<i>both nonsignificant</i>		<i>nonsignificant</i>

A series of McNemar pre-test versus post-test performance analyses confirmed that the false belief training group, but *not* the Level-2 visual perspective training group or control group, significantly improved in performance in the unexpected transfer Maxi false belief task (false belief training group, $\chi^2(1, N = 15) = 10.1, p < 0.01$; Level-2 visual perspective taking training group, $\chi^2(1, N = 13) = 0.0$, ns; control group, $\chi^2(1, N = 16) = 1.33$, ns).

3.2.ii Level-2 Visual Perspective Taking Performance

For the three Level-2 visual perspective taking tasks, children's responses were scored as pass/fail. Responses were scored as fail if the children answered

incorrectly, inappropriately or no response was given for any of the test questions. A series of Spearman correlations of the pass/fail responses was conducted for each of the three Level-2 perspective taking post-task trials (“self” and “other”). The mean rho correlation of the close-transfer standard Level-2 task post-task responses was 0.51 (range: 0.45-0.69). The mean rho correlation of the second close-transfer task, the policeman task, was 0.57 (range: 0.45-0.83). A mean rho correlation of 0.49 (range: 0.38-0.64) was observed for the distant-transfer Level-2 rotation task. Each of the visual perspective taking tasks included more than one trial and correct responses were awarded one point and no points were awarded for incorrect responses. Composite scores were formed for each task by summing the total number of correct responses for each task. A maximum score of four was possible for the two Level-2 close-transfer tasks: the standard Level-2 (with two “self” and two “other” trials) and the policeman tasks (with two trials, one each with one policeman and two policemen). The maximum composite score for the distant-transfer task (the rotation task) was six (three trials totalling three “self” and three “other” attributions).

Table 3.4 shows the mean pre- and post-test composite scores for the three groups on the three Level-2 visual perspective taking tasks. As can be seen in *Table 3.4*, the false belief training group did not show pre-test post-test mean composite performance change on the standard Level-2 visual perspective taking task, scoring a mean of 2.3/4.0 at both pre- and post-testing. The control group showed a pre-test score of 2.7/4.0 and a post-test score of 2.3/4.0 on the standard Level-2 task (See *Table 3.4*). As can be seen in *Table 3.4*, the Level-2 visual perspective training group improved from a pre-test mean composite score of 1.7/4.0 to a post-test mean composite score of 2.5/4.0 on the standard Level-2 task. The evaluation of distributions and a series Levene tests of homogeneity of variances showed that the data for the Level-2 tasks met criteria for parametric analyses. A series of paired-

samples t-test showed that, while there were no pre-test post-test increases in performance for the control or false belief training groups on the standard Level-2 task, $t(15) = 1.25$, ns; $t(14) = 0.0$, ns, respectively). A significant pre-post improvement for the Level-2 visual perspective taking training group was observed on this task, ($t(12) = 2.67$, $p < .05$).

Table 3.4: Pre- and post test Level-2 visual perspective taking mean composite scores for children in the false belief training, Level-2 visual perspective taking training and control groups.

Group	Standard Level-2 Task (maximum score =4)		Level-2 Policeman Task (maximum score =4)		Level-2 Rotation Task (maximum score =4)	
	Pre-test (SD)	Post-test (SD)	Pre-test (SD)	Post-test (SD)	Pre-test (SD)	Post-test (SD)
False Belief Training Group (n=15)	2.3 (1.2)	2.3 (0.98)	2.5 (1.6)	2.3 (1.2)	2.3 (1.4)	2.6 (1.1)
Level-2 Training Group (n=15)	1.7 (0.9)	2.5* (1.1)	2.2 (1.2)	3.0 (1.6)	1.8 (0.9)	2.4 (1.4)
	* $p < 0.05$					
Control Group (n=16)	2.7 (0.8)	2.3 (0.6)	2.7 (1.1)	2.1 (1.4)	2.4 (0.8)	2.3 (1.2)

Performance on the Level-2 policeman task was similar across groups. As can be seen in *Table 3.4* the false belief training group scored a mean composite pre-test score of 2.5/4.0 and mean composite post-test score of 2.3/4.0. Similarly, the control group pre-tested at 2.7/4.0 and post-tested on this task at 2.1/4.0 while the Level-2 training group scored 2.2/4.0 at pre-testing and 3.0/4.0 at post-testing (See *Table 3.4*). A series of paired-samples t-tests showed that there was no significant differences for

any group between pre- and post-test performance on the policeman task (false belief training group, $t(14) = 0.39$, ns; control group $t(15) = 1.55$, ns; visual perspective taking training group, $t(12) = 1.86$, $p = 0.09$).

Performance by the three groups on the Level-2 rotation pre- and post-tasks was consistently low. The false belief training group showed a pre-test mean composite score of 2.3/6.0 and with a mean composite post-test score of 2.6/6.0 (See *Table 3.4*). Similarly, the control group pre-tested with a mean score of 2.4/6.0 and showed a post-test mean composite score of 2.3/6.0 while the Level-2 visual perspective training group showed a mean pre-test score of 1.8/6.0 and a post-test score of 2.4/6.0 (See *Table 3.4*). A series of paired-samples t-tests showed that there was no significant differences for any group on pre- and post-test performance on the Level-2 rotation task, (false belief training group, $t(14) = 0.81$, ns; control group $t(15) = 0.24$, ns; visual perspective taking training group, $t(12) = 0.96$, ns).

3.3 Discussion

The main findings of this study replicate those of Experiment 1, in that mentalising training produced only training task related improvements in post-test performance. That is, training children in false belief understanding resulted in *only* close-transfer post-test improvements in mentalising understanding. The children in the false belief training group improved from pre-testing to post-testing on the unexpected transfer Maxi false belief task only, the task they were exposed to throughout training; this benefit did not, however, generalise to the nontrained deceptive box Smarties distant-transfer false belief tasks. Although the lack of false belief training generalisation to other nontrained false belief tasks finding supports the results of Experiment 1, it again conflicts with the Appleton and Reddy (1996), McGregor et al. (1998) and Slaughter (1998; Slaughter & Gopnik, 1996) studies

reported in the literature in which significant generalisation to distant-transfer tasks was observed.

As with the lack of false belief concept generalisation observed for the false belief trained group in the present study, the Level-2 visual perspective taking training group similarly showed significant improvement in pre- to post-test performance on the standard Level-2 visual perspective taking task *only*, the task on which they were trained. This improvement in Level-2 performance did not generalise to the nontrained distant-transfer Level-2 task or to a second Level-2 visual perspective taking training related task¹¹. This finding is consistent with a prior failed attempt to teach Level-2 visual perspective taking skills to young children reported in the literature by Flavell et al. (1981). The consistent finding in the present chapter across the false belief and Level-2 visual perspective taking training groups of improvement on only close-transfer but not distant-transfer tasks lends further evidence to suggest that children merely learned a task-specific strategy for success on training related tasks rather than any form of conceptual knowledge during the training.

Additional generalisation tasks were added to the present study in an attempt to investigate the possibility that false belief training generalisation may have been observed for other mentalising tasks in Experiment 1 had the children been tested on them. Moreover, a second non-false belief Level-2 visual perspective taking training group was added in order to further assess the potential generalisability of concepts trained within the mentalising domain. The findings revealed no such crossover

¹¹ Note that low statistical power may have been a consequence of the small sample size utilised in this study. For the Level-2 training group the standard Level-2 paired t-test is significant. Although the mean difference between the pre- and post test means are similar to that of the standard task the close-transfer policeman task just misses significance ($p=0.09$) A larger sample size may have shown a significant pre/post-test difference on the policeman task, suggesting some generalisation to this close transfer task. Future research should explore this issue.

effects between mentalising training and nontrained mentalising task performance for either the Level-2 visual perspective taking group or the false belief training group. That is, Level-2 visual perspective taking training did not serve to facilitate false belief performance and false belief training failed to boost Level-2 performance. No “knock on” improvements gained from either type of training were observed within the mentalising domain.

This finding conflicts with apparent training crossover findings observed by Slaughter and Gopnik (1996). Slaughter and Gopnik (1996, *Study 2*) found that children trained on false belief as well as a group of children trained on desire and visual perspective taking (coherence group) significantly outperformed at the time of post-testing a nontrained control group on non-training related tasks of appearance-reality (Flavell et al., 1986), sources-of-knowledge (O'Neill & Gopnik, 1991) and speaker certainty of mental states (Moore et al., 1989). That is, like the children trained specifically on false belief understanding, the children in the perspective-desire training showed generalisable training effects to false belief understanding and to other mentalising tasks. This crossover observed by Slaughter and Gopnik (1996) was taken as evidence in support of the conceptual coherence notion of mentalising.

It has so far been argued that Slaughter and Gopnik's (1996) failure to take pre-test and post-test data on all of the trained concepts and training tasks, as well as for the so-called generalisation assessments, is a severe limitation of their investigation. In their study, all children were pre- and post-tested on the false belief measures but no pre- or post-test data was collected for the trained concepts of desire and perception, nor was any pre-test data collected for the so-called generalisation tasks. Without pre-test data on these tasks, it is impossible to conclude with certainty whether the training schemes were responsible for the post-test performances of the

groups or if the children had already possessed the relevant abilities at the time of pre-testing.

In the present study, pre- and post-test data were taken on all training and transfer tasks. From this data a clear pattern of results emerged. Training was beneficial *only* on training related post-tasks for both training groups. No generalisation of the trained concepts was observed on non-training related tasks for both training groups. Moreover, no concept crossover generalisation effects were observed for either group. Training on false belief did not transfer to Level-2 visual perspective taking, nor did Level-2 visual perspective taking training transfer to false belief understanding. These findings show further support for the notion that mentalising abilities are not as readily trainable as prior training studies seem to suggest.

3.4 General Discussion: Experiments One and Two

Experiments 1 and 2 were designed to investigate the predictions of the theory of mentalising development, specifically the child-as-scientist hypothesis. The child-as-scientist account posits that early difficulties in mentalising are a consequence of competence errors grounded in immature mentalising theories. By this view, early experience in the domain penetrates immature mentalising theories and triggers theoretical restructuring via the incorporation of new information (Forguson & Gopnik, 1988, Gopnik et al., 1994, Gopnik & Meltzoff, 1997). The process is considered analogous to the process of scientific theory change; in the face of conflicting “data” in the form of experience or exposure to concepts of mentalising, existing theories may be overturned (Astington & Gopnik, 1991; Gopnik & Meltzoff, 1997; Gopnik & Wellman, 1994). From the child-as-scientist view, exposure to mentalising principles during a training scheme should be expected to provide sufficient “data” to trigger this type of theory reformation. Based on the child-as-

scientist hypothesis and the findings of prior training studies a mentalising training scheme methodology was adopted in Experiment 1 and the present study to test child-as-scientist theory theory view.

A consistent finding of both Experiment 1 and Experiment 2 was that, following mentalising training, children did not show significant generalisation of conceptual knowledge to nontrained tasks. These findings suggest that the “artificial” experience provided in the training schemes was not sufficient to induce the hypothesised theory reformation as proposed by the child-as-scientist view. The findings do, however, show some support for the modularity account of mentalising development. By the modular theory account, a training scheme targeting mentalising skills at a conceptual level of understanding would be expected to be largely ineffective. Unless the training specifically targeted information-processing abilities, the training would be expected have little impact on mentalising performance. By this view, early difficulties in mentalising are said to be constrained by performance errors as a consequence of immature information-processing abilities in the domain (Fodor, 1992). Mentalising development may not be triggered by experience in the domain but rather the mentalising modules may only come on-line once specific information-processing mechanisms have matured. The consistent trend for the trained children to show post-test improvements on the trained tasks only suggests that non-mentalising strategies for success were acquired. That notwithstanding, the negative training findings of the present studies do not show conclusive support for the modularity account of mentalising development, rather, these findings are consistent with the notion that mentalising abilities, at least in these types of training contexts, are not tapped at a conceptual level.

3.4.i Conclusion

It is clear from the main findings of Experiments 1 and 2 that the training schemes equipped the children with a capacity to pass close-transfer mentalising tasks but this did not generalise to other related tasks. The children did, therefore, learn something in the context of both the false belief training and Level-2 visual perspective taking training, although what was learned was unlikely to be at a conceptual level of understanding, as demonstrated by lack of any success on the distant-transfer tasks. It is concluded that mentalising capabilities are not as reliably “trainable” as initially reported in previous training studies (Appleton & Reddy, 1996; McGregor, et al., 1998; Slaughter, 1998; Slaughter & Gopnik, 1996). It is argued that methodological limitations of prior studies may have produced false positive training effects. In the present studies, stricter controls on sampling and generalisation assessments were adopted than those of prior training studies and no consistent, generalisable training effect was observed. It is acknowledged that these procedures deviated from the prior successful false belief training studies with respect to the implementation of group training schemes, rather than the one-to-one training sessions adopted in earlier studies. The purpose of using a group training scheme was to model more closely the children’s preschool learning environment and to provide greater exposure to topic materials through peer observation. It is possible that the group training strategy somehow diluted the training effect in these studies and that such capabilities are more effectively trained in one-to-one training sessions. One further difference is that there was not a systematic record of the participants’ answers to questions during the training sessions. This procedure was omitted because of the repeated number of conversations and question-and-answer sessions that the multi-story, combined training entailed. It is acknowledged that the lack of data of children’s responses may limit the ability to explain in quantitative terms what learning occurred during the training sessions.

Further research investigating the effectiveness of training studies in the domain of mentalising is necessary. Future training studies should systematically explore the factors that differ between the training studies reported here that show no generalisation and previous successful studies. Namely, the group versus individual method of delivery, the “full” versus “partial” pre-training failure criterion, and the effect of training false belief itself compared to developmentally related abilities such as Level-2 visual perspective taking. Alternatively, more in vivo approaches that model the apparent benefits of everyday social interaction could be attempted (Dunn et al., 1991; Perner, Ruffman, & Leekam, 1994). Identifying the natural domain boundaries and developmental onset of such concepts may help researchers to devise artificial training schemes that may successfully facilitate the proposed conceptual shift in mentalising understanding in young children.

3.4.i.a Research Plan for Chapter Four

Chapter 4 will cover Experiment 3, which attempts to more fully address the predictions of the theory theory as well as the simulation account of mentalising development. An empirical study is planned in attempt to test more directly the differential predictions of the two theories on tasks of belief through the design and implementation of a novel testing paradigm. This paradigm will attempt to assess and identify potential differences in young children’s belief performance under conditions proposed as “optimal” for the use of the theory theory’s theorylike reasoning and according to the conditions considered to be “optimal” for the conditions of simulation processing.

CHAPTER FOUR

Experiment Three

A Comparison of Conditions Optimal for Theorising or Simulation Processes and Thought Bubble Cueing on Young Children's True and False Belief Understanding

4.0 Introduction

Experiments 1 and 2 investigated the developmental theory theory account of mentalising, specifically the child-as-scientist hypothesis. The findings of these mentalising training studies failed to show any conceptual improvement in mentalising understanding, contrary to the prediction of the child-as-scientist hypothesis. The findings of both Experiments 1 and 2 contradicted the notion that mentalising abilities may be bolstered through training schemes.

While the theory theory perspectives have dominated the literature, the alternative simulation account of mentalising has challenged the theory theory hypothesis (Goldman, 1993; Gopnik, 1993). There has been surprisingly little empirical work investigating the differential predictions of the two perspectives. There is a distinct lack of empirical evidence attempting to resolve or clarify the differential predictions of theory theory and simulation perspectives, and for this reason, the theory theory - simulation debate remains primarily a theoretical one. While information-processing accounts will be investigated in later experiments, it was the primary aim of this study to identify and breakdown the differential predictions of the theory theory and simulation accounts of mentalising development and to assess these predictions empirically. As the simulation and theory theories are based on differing base principles, the theory theory on “theoretical knowledge” and the simulation on “shifting frames”, the circumstances considered “ideal” or

“optimal” to make use of either theoretical knowledge or the processes of simulation also differ. Building on basic assumptions and predictions of the theories, two conditions considered “optimal” for successful belief attributions were devised. Further support for these theories would be shown if young children’s performance can be bolstered by conditions that are ideal for either accurate belief attributions through theorising or through processes of simulation.

The sections to follow provide a brief review of the theory theory - simulation debate and an overview of the rationale pertaining to the development of the empirical paradigm designed to test these opposing views of mentalising development.

4.0.i The Theory Theory - Simulation Theory Debate

4.0.i.a The Theory Theory and Mentalising Rule Use

As we have seen, the main tenet of the theory theory¹² posits that the ability to deploy mental attributions is contingent on an internally represented theoretical knowledge base pertaining to the structure and function of human minds (i.e. Carruthers, 1996; Fodor, 1987; Wellman, 1990). According to this view, a logically coherent and connected set of internally represented laws of folk-psychological principles serves as the mechanism to explain and predict human behaviour (Stich & Nichols, 1992). The theory theory posits that the ability to make accurate mental attributions depends on the activation of an individual’s theoretical knowledge of how perception, attention, and belief interact to cause behaviour. When activated, the lawlike rules access knowledge relevant to behaviour explanation and prediction. Thus, in generating a belief attribution, an individual exploits his or her rules of human behaviour or knowledge base of “why people do things”. For example, when

¹²Note that this discussion pertains to the general principles of the theory theory hypothesis. For these purposes there is no need to distinguish between the child-as-scientist account and the modular theory theory account as both views agree upon the same basic theoretical principles.

attempting to attribute a belief to a target agent who, for example, is smiling, a behavioural rule about smiling will be activated such as: “When people exhibit behaviour Y (smile) they generally believe X (X = happy) [thus] I believe X (is happy).” Such rules of mentalising enable the predictor to read an agent’s behaviour for clues to explain another’s current mental state.

Evidence in support of the theory theory’s proposed rule use in mentalising comes from young children’s poor performance on tasks of inference. Failure on such tasks has been explained by theory theorists as a consequence of the overgeneralisation of the mentalising rule of “seeing leads to knowing” (Ruffman, 1996; Sodian & Wimmer, 1987; Wimmer, Hogrefe & Sodian, 1988). In tasks of inference, the child and a protagonist are shown, for example, a bag of identical objects such as sweets. The child but not the protagonist goes on to witness the transfer of one of the identical sweets to a second bag and the child is asked to indicate whether the protagonist knows which sweet was transferred. It is not until around the sixth year that children correctly acknowledge that the protagonist will know which type of sweet was transferred (through the inference that all sweets in the original bag were identical and therefore the sweet transferred had to have been one of that type). Theory theorists maintain that young children’s consistently poor performance on inference tasks suggests that young children err in overgeneralising the “seeing leads to knowing” rule: “He did not see (X) (X = sweet transfer). When people do not see (X) they do not know (Y) (which sweet transferred). He did not see (X) and therefore does not know (Y)”. Overgeneralisations of this rule suggest that young children have an inherent inability to acknowledge that inference may serve as a source of knowledge (Perner, 1991; Ruffman, 1996; Wimmer et al., 1988).

Ruffman (1996) devised a series of inference tasks to further test the theory theory’s proposed “seeing leads to knowing” rule. In this study both the child and the

protagonist were aware of the type of sweet transferred as identified by its place of origin, but only the child witnessed the actual transfer. In Ruffman's (1996) procedure, the protagonist was told by the experimenter from which container the sweet was taken from and an additional false belief condition was added. In the false belief scenarios, the protagonist was given misleading information about the location from which the sweet was selected. Ruffman (1996) found that children attributed false beliefs to protagonists in both the true and false belief scenarios. Ruffman (1996) argued that this finding suggests further evidence in support of the overgeneralisation of the "seeing leads to knowing" rule, that the child would have abided by the rule "The protagonist did not see and therefore does not know which sweet was transferred."

4.0.i.b The Simulation Theory and Shifting Frames

The simulation account of mentalising disputes the notion that processes of mentalising rely primarily on a formal body of knowledge organised into a theoretical structure. According to the simulation account, mental attributions are produced through the exploitation of an individual's *own* mental resources, activated off-line. (Gordon, 1986, 1996; Heal 1986, 1996). That is, initial mental states of a target agent are simulated and one's own decision making system is used to generate a decision of what to do, according to the pretend inputs, and this solution is then attributed (Goldman, 1989, 1995; Gordon, 1986, 1995). From the simulation perspective the mental state attribution is generated by "pretending" to formulate a decision of what an individual would do being in the other's shoes, whilst simultaneously attempting to accurately take into account the target's current perceptual reality. By this account, in predicting what a target agent will do, an individual feigns the current perceptual reality of the protagonist, for example, "*I believe X (I am happy).*" To do this, the simulator must first imagine the other's perspective (*happy situation*), input the

“pretend” states (*pretend-believe to hear a joke, pretend-feel amused*), classify the reaction (*know will smile*) then attribute this decision to the other “*He (target agent) will smile*” (Davies, 1994). Thus, the simulator shifts frames and then decides what to do under the feigned position of the other: “*I am happy, I (being target agent) will smile*”. From this account, in exploiting one’s own resources, the mental state generated through the experience of “being the other” serves as crucial input to the decision-making system.

The decision-making system makes reliable attributions, as it is identical to the system that operates under non-simulated conditions. According to Heal (1996), this human decision-making mechanism is similar enough across individuals for the simulator to exploit his or her own system for the processing of mental state attributions. Inaccurate attributions are likely to occur when the target agent’s current perspective is not accurately simulated by the simulator (Harris, 1992). It is the shifting-frames stage in the simulation process that is crucial for successful attribution. When inaccurate information pertaining to the target agent’s current perspective is supplied to the decision maker, regardless of whether a rational or even probable decision based on that information is produced for output, an inaccurate attribution is likely to result. If inputs different from those of the target agent are entered into the decision equation, they will generate a very different decision to the target agent, despite being correct for the given set of inputs. The key to successful mental state attribution, therefore, lies in making enough adjustments of the simulator’s own perspective to model the target agent’s perspective.

Harris (1992, 1995) has argued that standard false belief tasks, by their very design, serve to block the simulation process. By this view, failure by young children on these tasks is due to the complex nature of the required simulation rather than a lack of the ability to attribute mental states. On this account, standard false belief

tasks do not readily enable the child to exploit his or her own beliefs and desires to arrive at the attributions required to accommodate the perspective of someone holding beliefs the child does not share (Harris, 1991, 1992, 1995). In the case of false belief tasks, the child's own perspective and knowledge of the situation does not provide clues to the correct response. The child must ignore his or her own knowledge of the situation, (e.g. the true location of the object) and acknowledge an alternative perspective (e.g. wanting what the protagonist wants) in order to generate the correct inputs for entry into the decision-making system.

By this account, mentalising tasks that utilise the processes exploited during on-line processing are more likely to result in successful attributions. That is, the fewer default settings required to adjust, the more likely a correct response will be generated. Possible evidence in support of this view comes from studies demonstrating that young children shown to fail standard false belief tasks appear to successfully solve false belief tasks when assessed at the level of action (e.g. Freeman et al., 1994). In one study, children were asked to point to where a doll protagonist who is currently entertaining a false belief about a location of an object would look for the object. The findings showed that the children performed significantly better when physically responding with doll placement than when they were asked to report verbally where the protagonist thought the object was (Freeman et al., 1994). In another study, while 3-year-old children performed poorly when asked to indicate where a protagonist currently entertaining a false belief about the location of some food would look for it, 80 percent of the children looked in the correct location yet failed to make the correct attribution (Clements & Perner, 1994). This looking reaction to the correct location may suggest that children are solving the attribution at the level of action, but are unable to re-centre and take the decision making process off-line and attribute this solution to the protagonist.

4.0.ii Experimental Rationale: Direction of Attribution for “Optimal” Success

In order to address the basic assumptions of the theory theory and simulation views as described above, a mentalising attribution paradigm was created in which one condition was designed to provide optimal circumstances for the use of theoretical knowledge and a second condition was designed to provide optimal circumstances for simulation processing.

From a simulation perspective, the simulator agent relies on solving mental attribution at the level of action in the form of “*What will I (as simulated other) do now?*” (Gordon, 1986, 1995). It therefore follows that greater success on a mental attribution task in which an individual is asked to make a prediction concerning a protagonist’s *action* based on his currently held *belief* would be easier for a young preschooler than an attribution requiring a *belief* prediction as based on a current *action*. According to the simulation theory, solving an action-to-belief attribution would merely induce simulating the other’s perspective and solving the problem in terms of one’s own decision making processes. Alternatively, generating a *belief* attribution on the basis of a current *action* would be considered a more difficult task for the young child, as the process requires the child to make some “default” adjustments in order to abstract inferences which relate action and behaviour to mental states. That is, the child’s own mental states provide little clue as to what the target agent is “feeling”; therefore, the child’s decision making system may not be fed the correct inputs to match those of the target agent. The child’s own decision making mechanism may not be as likely to automatically generate an accurate decision on “*What will I (as simulated other) believe now?*” with as much success as “*What will I (as simulated other) do now?*”. Deciding what to *believe* as based on an *action* requires a more sophisticated simulation incorporating more than merely the activation of the child’s own off-line decision-making systems.

Conversely, from the theory theory perspective, rather than exploiting one's own resources as in case of simulation, theoretical rules of the mentalising knowledge base function according to the interconnected rules pertaining to "*why people do things*". It is argued here that predicting a target agent's belief based on his or her current *action* may be easier for the young child than an action-to-belief prediction. By this account, an individual may attempt to read an agent's behaviour for clues to explain his or her current mental state and then formulate the associated belief attribution according to the implicit rule system governing mentalising. Using theoretical knowledge to read and explain the behaviour of another would be easier than attempting to formulate a plan of action of what to do when given a protagonist's current mental states.

While no published study has attempted to test these differential predictions alongside each other within a single paradigm, some "prediction" versus "explanation" studies have been conducted, with mixed results. In line with the theory theory predictions, Bartsch and Wellman (1989), for example, found that, while only 31 percent of their 3-year-old sample successfully predicted a protagonist's false belief-based action, 66 percent accurately explained a protagonist's apparent erroneous action in terms of the protagonist's false belief. Similarly supporting the theory theory account, Robinson and Mitchell (1995) found that 3-year-olds were significantly better at identifying which one of two twins had been absent during an object transfer, as evidenced by his seemingly inappropriate search behaviour (action to belief), than they were at predicting where the absent twin would look for his object (belief to action). Similarly, Moses and Flavell (1990) found that young children observing a protagonist's inappropriate behaviour and surprise at an unexpected outcome were correctly able to explain the erroneous false belief based search for an object in an empty box. The children, however, incorrectly insisted that

the protagonist, despite discovering that the box was empty, still thought that the desired object was inside (Moses & Flavell, 1990).

4.0.iii Differential Predictions of Thought Bubble Cueing on Mentalising

A second respect in which the theory theory and simulation theory diverge is the use of imagery in the mentalising process. According to the simulation perspective, the use of pretence and imagery are prerequisite skills for the simulation process (Harris, 1992). By this account, the ability to adequately “shift frames” to assume the current perspective of a target agent requires the ability to “pretend” or imagine the simulated perspective of the target agent. Following this line of reasoning, a “thought bubble” cue, or image of the target agent’s thoughts, may bolster the young children’s ability to simulate the target’s current mental state accurately. Alternatively, from the theory theory perspective, no such skills of pretence or imagery are considered necessary for mentalising. From this perspective, children rely upon their increasing theoretical knowledge about the world to solve belief attributions. Thought bubble cueing, from this view, would be considered an “artificial” cue. People in everyday life do not have thought bubbles displaying their thoughts over their heads and therefore young children should not have developed any theoretical knowledge of thought bubbles pertaining to mental states.

Some empirical evidence suggests that imagery may have a facilitative effect on young children’s mentalising performance. For example, children’s false belief performance has been shown to be enhanced with the use of picture-posting cueing techniques (Freeman & Lacohee, 1995; Mitchell & Lacohee, 1991). Prior research has also demonstrated that upon introduction to thought bubbles, children as young as 3 years of age may appreciate the representational nature of the thought bubble pictures as a depiction of one’s thoughts (Wellman, Hollander & Schult, 1996; Custer, 1996). The evidence pertaining to the facilitative effects of thought bubbles cues on

false belief understanding, however, has been mixed. Custer (1996) found no evidence to support facilitative effects of thought bubble cueing on false belief understanding. In her study, children were told the protagonist's false belief and shown a drawing of the protagonist acting in a seemingly inappropriate manner. The children were then asked to select one of two thought bubble drawings which best depicted the protagonist's current thought. Custer (1996) found that the thought bubble cueing did not affect false belief performance.

In another thought bubble cueing study using a slightly different paradigm, Wellman et al. (1996) found a positive cueing effect on 3-year-olds' false belief performance. In this procedure, Wellman et al. (1996) showed the children a single thought bubble representing the protagonist's actual false belief about the contents of a box. When asked to report what the protagonist thought was in the box, the children's success rate was well above that for standard false belief tasks. It is possible that presenting only one possible thought bubble alternative in the Wellman et al. (1996) study, in comparison to selection from two possible thought bubbles as in Custer's (1996) study, may have resulted in Wellman et al.'s cueing effect. That is, the children may have been less likely to be drawn to the incorrect response if there was no thought bubble alternative presented to them. In addition, the Wellman et al. (1996) study differed from Custer (1996) with respect to the *type* of response elicited from the children. In the Wellman et al. (1996) study, the children were shown the thought bubble and asked to indicate verbally what the protagonist was thinking. Conversely, in Custer (1996), the children were asked to *select* which thought bubble best indicated what the protagonist was thinking. It is possible that this procedural difference may have contributed to the seemingly conflicting findings between Wellman et al. (1996) and Custer (1996).

4.0.iv Aims: Experiment Three

The primary aim of this empirical investigation was to assess directly the differential predictions of the theory theory and simulation theories on tasks of belief. When broken down to their most basic assumptions the two theories propose distinct perspectives on the processes involved in belief attribution and behaviour prediction. The simulation theory proposes that attributions are solved at a basic level of action rather than through the application of a sophisticated body of theoretical knowledge pertaining to human behaviour. Assessing whether young children's performance on two otherwise equivalent belief tasks differing according to whether the task was optimally designed for the use of theoretical knowledge or for simulation processing may provide evidence concerning how early reasoning of this type occurs.

An empirical paradigm was devised to measure differences in performance according to the two styles of attribution proposed by the two theories. That is, "optimal" conditions for theory- or simulation-type reasoning were devised using modified true and false belief tasks. An optimal simulation task would be one that facilitates a response that can be generated at a level of action. A task optimal for theoretical reasoning would be one that taps the individual's folk-psychological theories so that a given action or behaviour could be "read" and given meaning. Based on this line of reasoning, belief tasks were devised to measure *belief* attributions as based on a current *action* (optimal for the theory theory) and *action* prediction based on a currently held *belief* (optimal for the simulation theory). If, for both true and false belief tasks, a main effect for the direction of the attributions is observed (simulation or theory theory), then evidence would be shown in support of the notion that under "optimal" conditions for a particular process of belief reasoning (simulation or theory theory) belief attribution may be facilitated. This finding would lend support for the notion that when conditions are right according to the differential

hypotheses of the simulation or theory theory processes a particular process is exploited over the other.

The design of the current study also permits the investigation of a secondary hypothesis pertinent to the theory theory versus simulation debate. The secondary aim of this investigation was to measure the potential impact of thought bubble cueing on young children's belief task performance. In order to assess the impact of this type of artificial cueing on young children's belief performance, a second condition was incorporated into the design. Children in the "cued" groups were shown thought bubble pictures over the protagonist's head indicating his or her currently held true or false belief. It was predicted that thought bubble cueing, in providing clues to the protagonist's current thoughts would facilitate the children's performance on tasks of true and false belief in the simulation condition by reducing imagery demands required for perspective shifting. From the theory theory position, thought bubbles cues as an artificial medium would not be expected to have developed as part of young children's theoretical knowledge of mental states and behaviour. If, however, the facilitatory effect was only observed for the simulation group, evidence in support of the notion that imagery is a prerequisite skill for the simulation process would be found.

4.1 Method

4.1.i Design

A 2 X 2 between-subjects design was adopted for this investigation. The dependent variables were children's performance on two true and two false belief test questions. In the true belief scenarios, a story protagonist held or was acting on a true-to-fact belief. In contrast, the false belief scenarios included the protagonist holding or acting on an erroneous belief. There were two independent variables. The first was the "direction" of the true and false belief attributions: *simulation* or *theory*

theory. The children assigned to answer test questions from the *simulation* direction were told the protagonist's belief and were asked to predict his or her subsequent action. Alternatively, the children assigned to the *theory theory* direction were told the protagonist's current action and were asked to predict his or her corresponding belief. One half of the children were asked to make *simulation* direction attributions and the other half were asked to make *theory theory* direction attributions. The second independent variable was "thought bubble cue" presence. One half of the children in each of the *simulation* and *theory theory* direction conditions were presented with thought bubble cues over the protagonist's head. The remaining half of the children in each of the *simulation* and *theory theory* direction conditions received no thought bubble cueing. In total, four conditions were generated from this design: *simulation-cued*, *simulation-noncued*, *theory theory-cued*, *theory theory-noncued*.

4.1.ii Participants

Participants were 73 children recruited from four preschools and nursery centres in London. All children were native English speakers. The children were of mixed ethnicity, with approximately 40 percent Caucasian and 60 percent from ethnic minority groups. There were 17 children (8 boys, 9 girls) in the *theory theory-noncued* and 19 children (9 boys, 10 girls) in the *theory theory-cued* groups. In the *simulation-noncued* group there were 18 children (10 boys, 8 girls) and 19 children (11 boys, 8 girls) in the *simulation-cued group*¹³. The mean age of the children assigned to the *theory theory-noncued* group was 4:0 (years: months) (standard deviation: 4.5 months) ranging from 3:3 to 4:6. The *theory theory-cued* group had a mean age of 4:1 (years: months) (standard deviation: 4.9 months) ranging from 3:3 to

¹³Note that, because of experimenter error, the data of two children from the *theory theory-cued* group (N=19-2) and one child from the *simulation non-cued* group (N=19-1) was excluded from the descriptive statistics presented above and any analyses of the results. The experimenter misread the testing scripts to these children during testing.

4:6, respectively. The mean age of the children assigned to *simulation-cued* group were 4:1 (years: months) (standard deviation: 3.2 months) ranging from 3:3 to 4:6 and 3:10. The mean age of the *simulation-cued* group was 3:10 (years: months) (standard deviation: 5.6) ranging from 3:0 to 4:6, respectively. Group assignment was pseudo-random, matching for age. A one-way analysis of variance test showed that there were no significant differences between the ages of the children as assigned to the four conditions, ($p > 0.1$, two-tailed).

4.1.iii Materials

Two sets of cartoon true and false belief scenarios for each of the four conditions: *theory theory-cued*, *theory theory-noncued*, *simulation-cued*, and *simulation-noncued*. The scenarios were designed to be identical in content across the four conditions; however, they differed crucially in respect of the specifications of each condition according to the direction of prediction and presence of cueing. The belief scenarios were based in part on the procedures developed by Bartsch and Wellman, (1989) and Wellman and Bartsch (1988). *Table 4.1* displays example true and false belief scripts for the four conditions. *Figure 4.1* shows example cartoon drawings that correspond to the true belief scenario depicted in *Table 4.1* for each of the four conditions. *Figure 4.2* shows cartoon examples that correspond to the false belief scenario shown in *Table 4.1* (See *Appendix V* for remaining two scenario scripts and corresponding cartoon thought bubble drawings). A cartoon drawing depicting a girl with a thought bubble of flowers over her head was also used for pre-testing the children in the two thought bubble cueing conditions (See *Appendix VI* for script).

Table 4.1: Example true and false belief scenario testing scripts for the simulation-cued, simulation-noncued, theory theory-cued and theory theory-noncued conditions.

	True Belief Scenario	False Belief Scenario
Simulation-noncued	Here is Jane. Jane is looking for her kitten. Jane thinks her kitten is under the piano. Where will Jane look first for her kitten? Correct Response: Piano	Here is Rob. Rob is looking for his shoes. Rob thinks his shoes are in the cupboard but his shoes are really under the bed. Where will Rob look first for his shoes? Correct Response: Cupboard
Simulation-cued	Here is Jane. Jane is looking for her kitten. Jane thinks her kitten is under the piano (thought bubble of kitten under piano) Where will Jane look first for her kitten? Correct Response: Piano	Here is Rob. Rob is looking for his shoes. Rob thinks his shoes are in the cupboard (thought bubble of shoes in cupboard), but his shoes are really under the bed. Where will Rob look first for his shoes? Correct Response: Cupboard
Theory Theory-noncued	Here is Jane. Jane is looking under the piano for her kitten. Why is Jane doing that/What might she be thinking? Correct Response: Kitten is under the piano.	Here is Rob. Rob is looking for his shoes. Rob is looking in the cupboard but his shoes are really under the bed. Why is Rob doing that/What might he be thinking? Correct Response: Shoes are in cupboard.
Theory Theory-cued	Here is Jane. Jane is looking under the piano for her kitten. Which one of these pictures shows what Jane is thinking? (thought bubbles of kitten under piano, kitten under chair). Correct Response: Kitten is under the piano.	Here is Rob. Rob is looking for his shoes. Rob is looking in the cupboard but his shoes are really under the bed. Which one of these pictures shows what Rob is thinking? (thought bubble of shoes under bed, shoes in cupboard). Correct Response: Shoes are in cupboard.

Figure 4.1: Example true belief scenario cartoon drawings from each of the four conditions (See Table 4.1 for corresponding scripts).

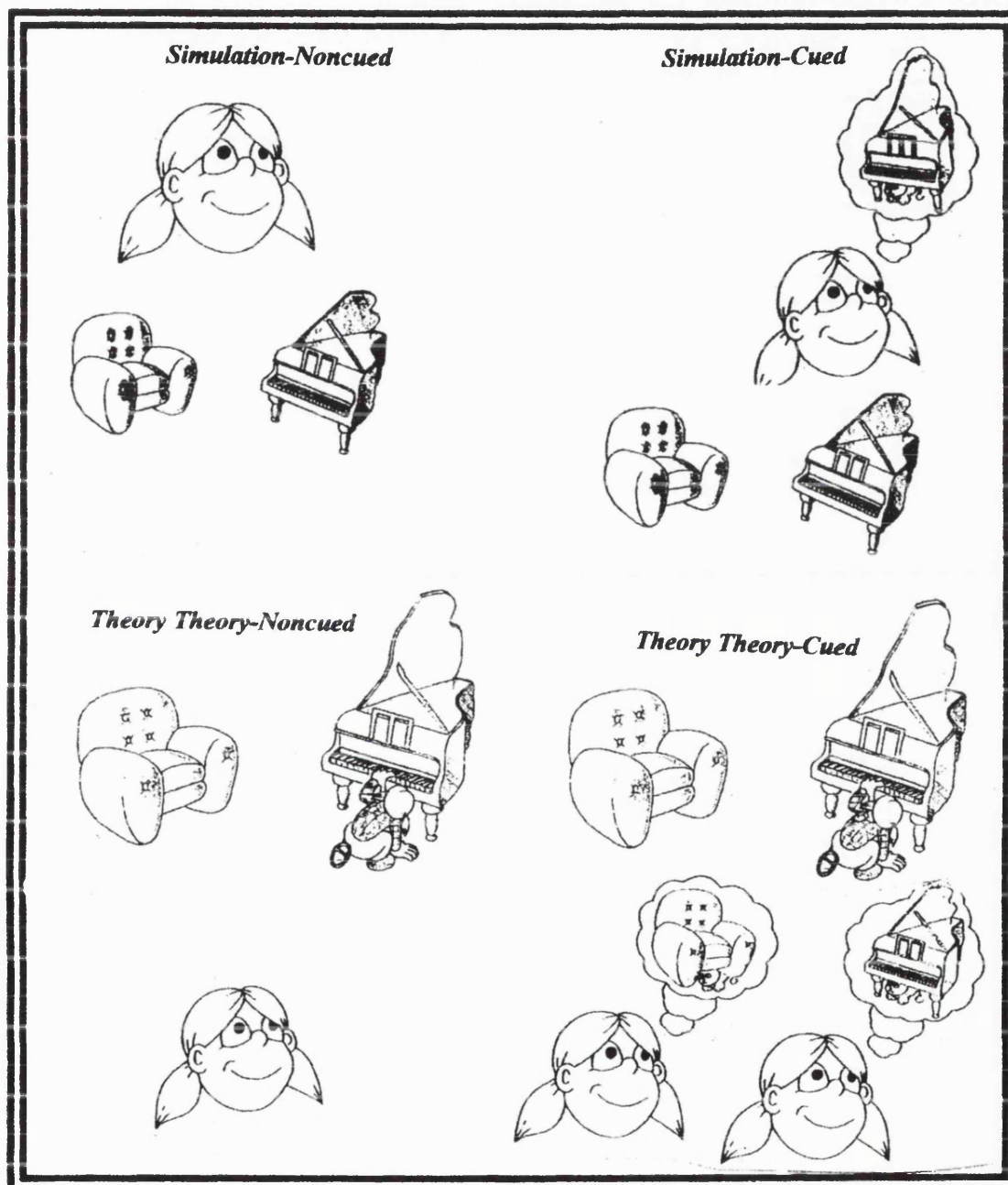
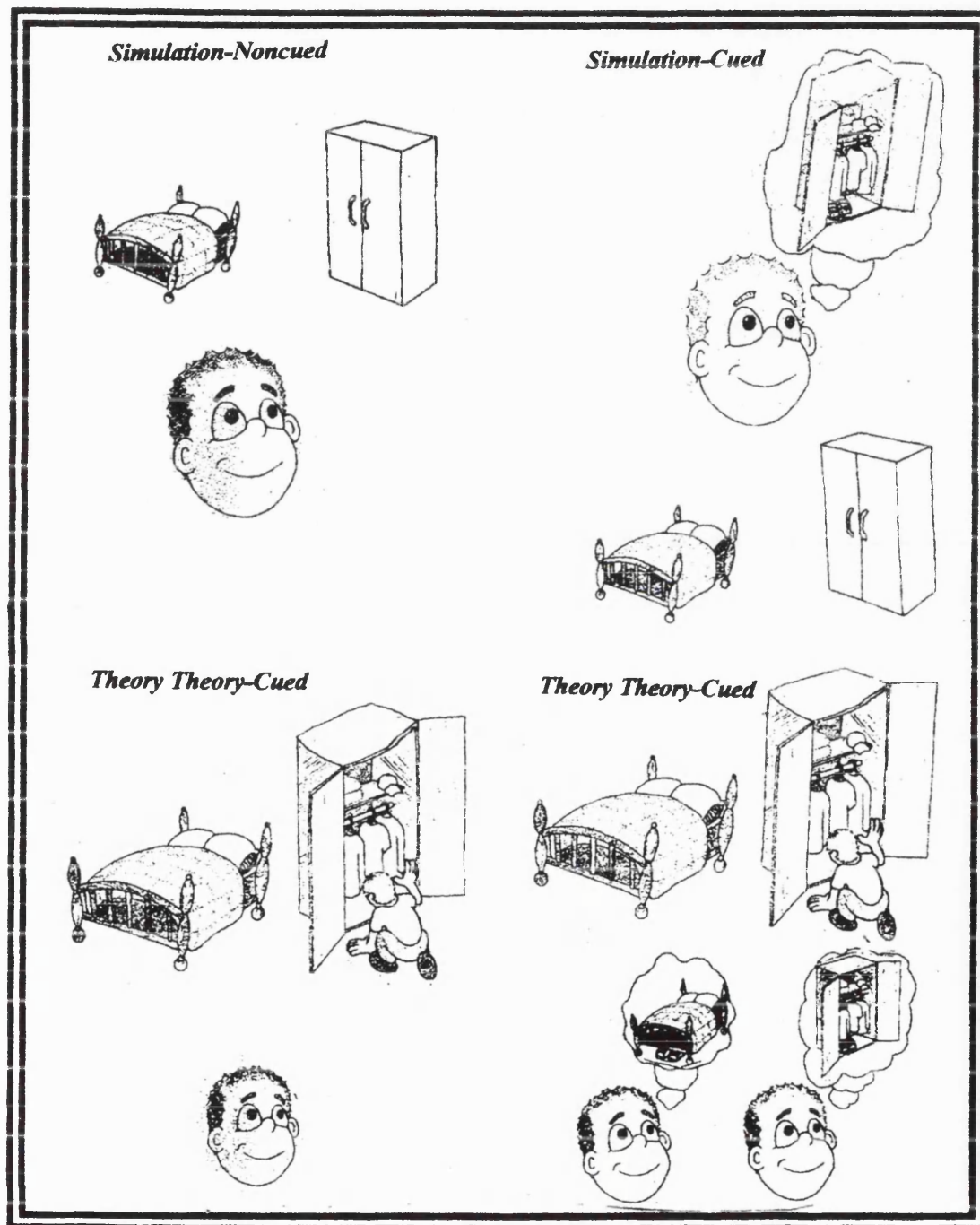


Figure 4.2: Example false belief scenario cartoon drawings from each of the four conditions
(See Table 4.1 for corresponding scripts).



4.1.iv Procedure

The children were invited to play some games with the experimenter. All testing was conducted in a secluded area of the nursery. The children sat opposite and facing the experimenter. The two true and two false belief scenarios were presented in a counterbalanced order across children, such that one half of the children were tested on one set of true and false belief questions (those presented in *Table 4.1*) followed by the second set of true and false belief questions (as those presented in *Appendix V*). The order of presentation of true and false belief scenarios within each of these sets was counterbalanced so that one half of the children were first tested on the false belief question, then tested on the true belief test question; this order was reversed for the second set of materials. The children in the cueing conditions were presented with a brief pre-testing session based on the procedures of Custer (1996) in order to familiarise them with the purpose of thought bubble cues¹⁴ (See *Appendix VI* for script).

4.2 Results

4.2.i Scoring

Children were scored on a pass/fail criterion for each of the two true and two false belief test questions. The numbers of children from the entire sample passing each of the four test questions are displayed in *Table 4.2*. As can be seen from *Table 4.2*, task difficulty for the two true belief question was similar with 60.3 percent and 69.9 percent of the sample passing each. A McNemar analysis confirmed that there was no significant difference between the number of children in the sample passing the two true belief questions, $p > 0.1$, (two-tailed). As can be seen in *Table 4.2*, percentages of children from the sample passing two false belief test questions was

¹⁴All children in the two cued conditions successfully passed control questions of the pre-testing ensuring that they understood the concept of thought bubbles as representing pictures of thoughts.

also similar at 56.2 percent and 45.2 percent passing each task. A McNemar analysis showed that there was no significant difference between the number of children passing the two false belief tasks, $p > 0.1$ (two-tailed).

Table 4.2: Number of children in the sample passing the four belief test questions.

Scenario Type	Number of Children Passing
<i>True Belief Scenario #1 (As presented in Table 4.1)</i>	51/73 (69.9%)
<i>True Belief Scenario #2 (As presented in Appendix V)</i>	44/73 (60.3%)
<i>False Belief Scenario #1 (As presented in Table 4.1)</i>	33/73 (45.2%)
<i>False Belief Scenario #2 (As presented in Appendix V)</i>	41/73 (56.2%)

With no significant differences in true belief task difficulty or in false belief task difficulty shown, it was considered justified to generate true belief and false belief composite scores to analyse children's overall performance for both types of tasks: true and false. One point was awarded for each correct response and no points were awarded for incorrect responding. Composite scores were calculated by independently summing the number of correct true belief and the number of correct false belief responses. All children responded to two true and two false belief test questions. Therefore, a maximum total composite score of two was possible for both the true and false belief composite scores.

4.2.ii Statistical Analyses

4.2.ii.a True and False Belief Task Performance

The sample's overall performance was higher on the true belief scenarios than the false belief scenarios. The mean composite score for true belief was 1.3/2

(standard deviation 0.66) was higher than the mean composite score of 1.0/2 (standard deviation 0.80) for false belief (See *Table 4.3* Row One). A pair-wise comparison confirmed true belief performance to be significantly better than false belief, ($t(72) = 2.44$, $p < 0.05$, two-tailed).

Table 4.3: Mean true belief and false belief composite scores for the simulation-noncued, simulation-cued, theory theory-noncued and theory theory-cued conditions.

	True Belief Composite Score Mean (SD)	False Belief Composite Score Mean (SD)
Sample (N=73)	1.3 (0.66)	1.0 (0.80)
<i>Simulation-Noncued</i> (n=18)	1.06/2 (0.64)	0.83/2 (0.70)
<i>Simulation-Cued</i> (n=19)	1.63/2 (0.50)	1.37/2 (0.77)
<i>Theory Theory-Noncued</i> (n=17)	1.18/2 (0.64)	1.06/2 (0.83)
<i>Theory Theory-Cued</i> (n=19)	1.32/2 (0.75)	0.79/2 (0.86)

4.2.ii.b Direction of Attribution and Cueing Effects

Table 4.3 shows the mean composite performances of the four groups (*simulation-cued, simulation non-cued, theory theory-cued, theory theory-noncued*) on the true and false belief tasks. No main effects were observed for the direction of attribution. That is, there were no significant differences in true belief, ($F(1,69) = 0.427$, ns, two-tailed) or false belief, ($F(1, 69) = 0.912$, ns, two-tailed) performance between the *simulation (cued, noncued)* groups and the *theory theory-(cued, noncued)* groups.

The mean true belief and mean false belief composite scores of the four conditions were analysed separately via two-factor (*Direction X Cueing*) analysis of

variance. The analysis revealed a main effect of cueing for the true belief, ($F(1, 69) = 5.75, p < 0.05$, two-tailed) but not false belief scores, ($F(1, 69) = 0.516$, ns, two-tailed). This finding suggests that the presence of thought bubble cues significantly facilitated true belief (but not false belief) task performance, regardless of the attribution direction (*simulation* or *theory*).

A significant (*Direction X Cueing*) interaction effect was observed for the false belief, ($F(1, 69) = 4.73, p < .05$, two-tailed) but not true belief scores, ($F(1, 69) = 2.14$, ns, two-tailed). *Post hoc* analyses of false belief scores showed that the *simulation-cued* group significantly outperformed the *theory theory-cued* group, ($t(72) = 2.21, p < 0.05$, two-tailed). No significant difference in false belief performance was observed between the *simulation-noncued* and *theory theory-noncued* groups, ($t(72) = 0.87$, ns, two-tailed).

4.3 Discussion

The primary aim of this empirical investigation was to assess directly the differential mentalising predictions of the theory theory and simulation theories on tasks of belief. When broken down to their most basic assumptions, the two theories suggest that the proposed mentalising processes may operate differently, depending on whether a task is of belief attribution or of behaviour prediction. The simulation theory posits that attributions are solved at a basic level of action, such that mentalising tasks of *belief-based behaviour prediction* should provide optimal circumstances for a successful simulation. Unlike action-to-belief attributions, belief-to-action predictions enable a straight simulation with no default adjustments necessary. In this instance, when the belief is given and the associated inputs merely need to be plugged into the decision-making systems. Alternatively, the theory theory proposes that mentalising attributions are generated through the application of a sophisticated body of theoretical knowledge pertaining to human behaviour. Unlike

the simulation theory, from the theory theory view, tasks of *action based belief* should provide optimal circumstances for generating a correct attribution. Drawing on the theoretical knowledge pertaining to human behaviour, this type of mental attribution may be generated by “reading” the target agent’s behaviour. That is, the target agent’s behaviour provides a clue to his or her current internal state. This may be more difficult to deduce when no behaviour is exhibited as in the case of belief-to-action predictions. Based on this rationale, an empirical paradigm was devised to measure the proposed differences in mentalising performance according to these two styles of attribution. “Optimal” conditions for theory theory-type reasoning (action-to-belief prediction) or simulation-type reasoning (belief-to-action prediction) were designed for both true and false belief tasks.

The findings obtained from this type of paradigm revealed that, contrary to the proposed differential expectations of the theory theory and simulation theories, tasks of predicting *belief as based on action* were neither easier nor more difficult than predicting *action as based on belief*. Had a performance bias been observed for a particular direction of prediction considered to be “optimal” for either simulation or theory theory processes this would have suggested that early belief attributions may be generated in accordance to the respective simulation or theory theory view. No such performance effect, however, was observed between the two directions of prediction.

A secondary aim of this study was to assess the potential impact of thought bubble cueing on children’s true and false belief performance. The findings revealed that thought bubble cueing had a differential impact on young children’s performance. When asked to solve tasks of true belief, children in both the *simulation* and *theory theory-cued* groups performed significantly better than those in the *simulation* and *theory theory-noncued* conditions. Thought bubble cueing enhanced true belief

performance for both *simulation* and *theory theory* groups. No main effect for cueing was found for false belief tasks; rather, a significant cueing by direction interaction was observed. Only under the condition considered optimal for simulation reasoning did a significant facilitative cueing effect emerge for tasks of false belief.

The thought bubble cueing facilitation effect for true belief scores for the *simulation* and *theory theory* directions shows that children's true belief performance may be bolstered with artificial devices such as cartoon drawings depicting the protagonist's thoughts. Moreover, the successful false belief thought bubble cueing in the *simulation* direction further suggests that under special circumstances (belief-to-action prediction but not action-to-belief prediction) cues provided the children with some form of mentalising benefit. The thought bubble cueing was thus effective in bolstering belief performance in three of the four conditions of the present study. In an earlier attempt to cue false belief through the utilisation of thought bubbles, however, Custer (1996) found no facilitative effect of thought bubbles on false belief performance. Custer (1996) presented children with two possible thought bubble representations of a protagonist's false belief. The children were asked to indicate which thought bubble adequately displayed the protagonist current thought. Despite the cueing on standard tasks of false belief, the children performed poorly on this type of false belief attribution. This finding was supported in the present study. Custer's (1996) procedure was very similar to the *theory theory-cued* condition of the present study in that the children were asked to select the thought bubble which best represented what a protagonist was thinking (action-to-belief prediction). Using a slightly different thought bubble procedure, Wellman et al. (1996) found that cueing children with a thought bubble representing the protagonist's thoughts and asking for a verbal report of a protagonist's false belief bolstered performance (belief to belief). It is possible that this procedural difference may have contributed to the seemingly

conflicting findings between the Wellman et al. (1996) and the findings of the present study and Custer (1996). Further research investigating such procedural differences in the utilisation of thought bubble cues on young children's false belief understanding is necessary to clarify and further explore these methodological issues.

The cue facilitation effects for true and false belief attributions under "optimal" simulation theory conditions in this study support a simulation-processing view. The use of pretence and imagery are considered prerequisite skills to the simulation process. In order to accurately simulate another's current perspective requires the exploitation of imagination skills to shift frames (Harris, 1992). Feigning the target agent's current perception of reality is considered the difficult part of the simulation, as incorrect attributions generally arise when inputs are entered into the decision-maker that do not match those of the target agent (Harris, 1992). The decision-maker operates exactly as it normally would for the simulator agent in the generation of a real plan of action; however, the solution is taken off-line and attributed to the target. Incorrect responses are unlikely to be produced at the decision making stage but rather at a stage of default setting. An individual with better skills in imagery and pretence would therefore be better at accurately shifting frames for default settings. Following this line of reasoning, a thought bubble cue as a picture of the target agent's thoughts may have bolstered the children's emerging abilities to imagine the target's current mental state accurately. That is, with a picture provided of the protagonist's thoughts, the child need not adjust default settings such as setting aside his or her knowledge the object's location to consider what the protagonist may or may not know or to consider a desire or belief in which the child does hold. A child in the *simulation-cued* situation merely needs to read off the thought as depicted in the thought bubble and insert this information as input into normal decision-making processes. In revealing what the story protagonist was thinking, the thought bubble

may have enabled the child to bypass the difficult stage of shifting frames in the simulation process. As such, the child need not imagine the protagonist's perception of reality; rather he or she simply need to solve the problem at the level of action and attribute the solution to the protagonist.

It is also possible that the false belief cue facilitation effect for the simulation group and not for the theory theory group may suggest that there is something specific to the process of predicting actions from beliefs which may be bolstered with the pictorial representational clue (Mitchell & Lacohee, 1991; Freeman, 1994; Freeman & Lacohee, 1995). The cue interaction effect may suggest that there is more than one process for solving belief attributions. It is possible that, when the conditions are optimal for the exploitation of theorylike processes for belief attribution, the thought bubble cue disrupts the process because of its artificial nature. For the action-to-belief attribution, they may serve to provide the inputs to be entered into the decision-maker, from the belief-to-action prediction; they may offer only two alternative possibilities of what the protagonist could be thinking. According to the theory theory view, mental state attribution involves a domain of interconnected theoretical knowledge structures acquired through experience. In this respect, it is unlikely that the child's understanding of human behaviour would include the "artificial" experience of the relation between thought bubbles and behaviour. Children do not typically attempt to reason about thoughts via this artificial medium. It is therefore possible that, for false belief tasks, the pictorial cue may disrupt and inhibit the theoretical reasoning process. It is possible that the theorylike mechanism is represented semantically so that the pictorial representation of the thought bubble cue does not tap this semantic representation for activation. The fact that the cueing did not bolster false belief performance in the theory theory direction may not be in direct conflict with the predictions of the theory theory.

It is acknowledged that a potential limitation of this investigation is the fact that it is impossible to know with certainty if the thought bubbles were truly understood as representations of the protagonist's thoughts. It is entirely possible that the children merely "matched" the picture depicted in the thought bubble to the one that was most similar amongst the possible response choices rather than considering mental states at all. This explanation however, seems unlikely, as the *theory theory-cued* children showed the opposite to this type of strategy for false belief attributions. Nevertheless, the "matching" possibility may be considered a methodological limitation of the design of this study. Future replication attempts could overcome this potential confound by removing some of the cartoon components of the scenarios that may not be crucial to experimental design. For example, in the *theory theory* conditions, the initial cartoon drawings of the two possible locations may be omitted and described by script alone. That is, rather than showing the children cartoons pictures of the two locations, the child may just be told where the protagonist is looking for the object. Similarly, in the simulation conditions, the children need not be shown drawings of the possible locations depicting where the protagonist may look. Instead, merely asking the children where the protagonist will look for the object would suffice. Omitting the visual presentation of the locations in these ways would eliminate the possibility that the children were matching pictures when responding rather than considering mental states and how they impact the protagonist's behaviors.

4.3.i Conclusions

The present study attempted to make differential theoretical predictions about young children's belief understanding as based on two major theories of mentalising and to systematically test these differences in a controlled paradigm. While the

findings suggest that young children perform similarly on mentalising tasks proposed as “optimal” for simulation processes (belief to action) and tasks proposed to be “optimal” for theory theory process (action to belief) it is possible that the novel empirical measures used herein may have been insensitive to the hypothesised differential predictions of the two theories. That is, while it is clear that children performed equally on the tasks designed according to simulation and theory theory directions, there may be fundamental differences in theorylike versus simulation-type reasoning that this paradigm could not access or identify, such as the theoretical knowledge base of mentalising or the simulation process of shifting frames. Further research investigating such potential differences is necessary to provide more conclusive evidence pertaining to this domain.

The facilitative effect of thought bubble cueing on young children’s true belief performance and the significant thought bubble cue by direction of prediction effect for false belief in the simulation direction supports the simulation notion that imagery is involved in the formulation of mentalising attributions. Although these findings do not conclusively reveal whether the processes of mentalising are in fact a product of simulation processes, they provide some insight into how the process of mentalising may be facilitated in young children. Further studies are planned to explore the impact of imagery on young children’s mentalising performance.

4.3.i.a Research Proposal for Experiment Four

Experiment 3 revealed that thought bubble cueing facilitated both true and false belief performance. The specific nature of the false belief cueing interaction effect demonstrated that, when conditions are optimal for the exploitation of simulation processes, the thought bubble representational clues were effective in bolstering performance. Thus, when children are presented with a visual thought bubble cue, the processing load required for some types of belief attribution may be

lifted. This conclusion is in line with the simulation account of mental state attribution. In the simulation account, it is the exploitation of pretence and imagery skills for shifting frames to another's perceptual reality that is the difficult stage of false belief attributions (Harris, 1996). Thus, the thought bubbles may have facilitated the children's ability to shift frames adequately.

It is argued that the facilitative thought bubble cueing effects on young children's belief performance in the present study may also support contemporary information-processing views of mentalising development. In chapter 5, theoretical issues pertaining to the potential facilitative affects of imagery on young children's belief attribution performance will be explored more fully. Before Experiment 4 is discussed in the next chapter, the differential predictions of the developmental theories of mentalising pertaining to the use of imagery will be overviewed. Contemporary theoretical stances on the relationship between imagery, pretence, false belief, as well as the potential influence of representational understanding, are also addressed in the next chapter.

CHAPTER FIVE

Experiment Four

False Belief Success Under Conditions of Pretence: A Special Circumstance of Representational Understanding or Consequence of a Reduced Information-Processing Load?

5.0 Introduction

The goal of the empirical work of this thesis is to investigate the predictions of contemporary accounts of mentalising development. Experiments 1 and 2, contrary to the theory theory's child-as-scientist theory reformation hypothesis, yielded little evidence that mentalising capabilities can be successfully trained in young children. In Experiment 3, a novel empirical paradigm was used to assess the predictions of both the theory theory and the simulation theory concerning tasks of belief. Modified true and false belief tasks were devised for one condition to create "optimal" circumstances for the exploitation of the theory theory's proposed theoretical knowledge structures. A second condition was designed to provide "optimal" circumstances for the use of simulation processes. In Experiment 3, no difference in belief performance was observed between the optimal simulation and theory theory conditions.

Experiment 3 did reveal, however, that thought bubble cueing facilitated both true and false belief performance. In both the theory theory optimal and the simulation theory optimal conditions, cueing facilitated true belief performance. Also, in the *simulation-cued* group (belief-to-action prediction) belief performance was significantly higher than the children in the *theory theory-cued* group (action-to-belief prediction). A false belief cueing interaction effect was found such that, under belief-to-action but not action-to-belief prediction conditions, the thought bubble

representational cues boosted performance. These results suggest that when a visual thought bubble cue is presented, the information-processing load required for some belief attributions is lifted. This is consistent with the simulation account of mental state attribution, in which it is the exploitation of the pretence and imagery skills required in order to shift frames when forming accurate false belief attributions that is difficult (Harris, 1996). These thought bubbles, then, may have facilitated the children's ability to shift frames adequately for the belief-to-action false belief test questions.

In this chapter, theoretical aspects of the facilitative effects of imagery on young children's belief attribution performance will be explored in detail. In the sections to follow, the predictions of the various developmental theories of mentalising regarding the use of imagery are reviewed. Contemporary theoretical perspectives on imagery, pretence, false belief and their relationships to representational understanding are also covered.

5.0.i Representational Status and False Belief Failure

As outlined in Chapter 1, a great deal of research has been devoted to the development of false belief understanding. As assessed by standard tasks, false belief understanding has been consistently shown to emerge at about fourth year of life (e.g. Gopnik & Astington, 1988; Wimmer & Hartl, 1991). Mastery of false belief tasks has come to be regarded as an indication of full-blown first order mentalising understanding (Charman, 2000). Although the age at which children begin to succeed on false belief tasks has been well established, there is considerable debate over what cognitive-developmental processes enable false belief success to occur at four years of age, but not before. False belief task success has therefore come to define an apparently critical stage in the development of mentalising understanding relating to how mental entities influence human behaviour (Davies & Stone, 1995).

5.0.i.a False Belief Failure as a Representational Understanding Deficit

As we saw in chapter 1, false belief task failure prior to the late preschool years has been explained by some theory theorists as indicative of a broader difficulty in understanding the underlying representational nature of beliefs (Forguson & Gopnik, 1988; Gopnik & Slaughter, 1991; Perner, 1991). Forguson and Gopnik (1988) proposed that, by 4 years of age, children acquire a so-called representational model of mind, the appreciation that thoughts represent the world, but that the world is nonetheless independent of thought. From this perspective, mental representations have two primary components, the *representational attitude* (i.e. mental states such as thinking, knowing, believing and wanting) and the *symbolic content* that is represented propositionally (Forguson & Gopnik, 1988). That is, mental states, like photographs, are symbolic in nature and only *stand for* a particular interpretation of the world. The ability to represent representations, according to this view, is the key to holding a representational model of mind.

Following a similar line of reasoning, Perner (1991) proposed that the changes in false belief understanding throughout the preschool years mark a conceptual shift in the understanding of mental states: from a non-representational to a “Representational Theory of Mind” (RTM) (Perner, 1991). Perner (1991, 1995) proposed that full-blown adult mentalising abilities are a reflection of the young child switching from a conception of the mind understood as a system whereby mental states serve to explain action, to a system that appreciates that mental states are understood to serve a representational function. Recently, Perner (1995) has stated that the deficit in the preschool years applies specifically to the lack of a representational understanding of beliefs. Prior to the onset of RTM understanding in the early preschool years, it is proposed that, while young children can evaluate propositional attitudes, they are incapable of understanding that propositions are merely evaluations of perceptual reality (Perner, 1995). According to Perner (1995), before RTM, children operate as

situation theorists, whereby they can break from current reality and represent a reality alternative by “acting-as-if” a proposition was true, as in pretend play. The 3-year-old situation theorist understands that individuals are related to situations but does not consider that people have individualised perceptual representations of situations. In order to understand beliefs and false beliefs an understanding of what beliefs are about, as well as how states of the world are thought about, is required (Perner, 1995).

By this view, the difference between success and failure on tasks of false belief is whether or not children apply the notion of a mental representation as a symbol of a particular mental state that need not be a reflection of true reality (Perner, 1991). False belief failure is considered to be a reflection of an inability to separate the state of the world that the belief is about, and how that belief relates to the real world. In other words, a failure to appreciate that beliefs may misrepresent reality (Perner, 1995). Perner (1995) argued that young children have *some* understanding of mental states as attitudes toward propositions and, prior to a RTM, they may evaluate the truth value of the following propositions:

“attitude (P)”

“attitude (P) and P is false”

Without a RTM, however, they may represent or relate an individual with a mental state to a proposition, but they cannot reason about a mental state with a different truth value from that which they hold:

“attitude (P) O evaluates (P) as true but P is false” (Perner, 1995, p244).

(“O” = other individual).

According to the representational deficit account, false belief failure in the early preschool years is attributed to the failure of young children to acknowledge beliefs *as* representations (Forguson & Gopnik; Gopnik & Slaughter, 1991; Perner, 1991). In support of this notion are the findings that young children do not show

difficulty in solving other types of mental state attributions such as desires which, it is argued, do not require a representational understanding (Gopnik & Slaughter, 1991).

5.0.i.b Representational Understanding Prior to False Belief Success

As outlined in chapter 1, Leslie (1988) identified that an innate, domain-specific module called the “Theory of Mind Mechanism” (ToMM) as the source of mentalising development. Leslie (1987, 1988) proposed that the ToMM enables the concurrent entertainment of three types of representational relations. By this view, a *primary representation* describes the true state of current reality and a second *decoupled representation* enables an opaque report of the reality to be held alongside the *primary representation*. The ToMM is operated by a *decoupling mechanism* that allows an individual to handle mental phenomena, such as dreams and pretences, without interference from the true state of reality (Leslie, 1994). The ability to metarepresent, which Leslie (1987) called “M-representation”, is the process by which the decoupling mechanism arranges propositional attitudes according to *informational relations*. The informational relationship operates as a function of the target agent, reality and the “decoupled” situation so that it is possible to hold beliefs that contradict reality. For example, it is possible for an individual to hold alternative truth statements simultaneously according to the following example:

M-representation = *Agent (i.e. I) (Informational Relationship Toward Referent)*
(i.e. can't believe) Truth Statement (i.e. it is not butter).

The ability to M-represent enables attentional resources to be automatically directed toward the mental states of agents despite their opaque nature. The ToMM does not require knowledge of mental states as concepts themselves, such as what a mental state of belief *is*; rather it requires merely the recognition of mental states (Roth & Leslie, 1998). According to Leslie's (1994b) M-representational theory, false belief failure does not reflect a fundamental representational understanding

deficit but the result of performance limitations and the heavy task demands of the standard false belief procedure. According to this view, false belief tasks are limited in what they reveal about young children's representational understanding. Children err as a consequence of non-mentalising processing mechanism limitations, specifically that of inhibition (Leslie, 1994b). By this account, children are said to fail false belief tasks because they are unable to disengage from the true state of belief to hold the target agent's non-factual belief (Leslie & Polizzi, 1998; Roth & Leslie, 1998). Leslie (Leslie & Polizzi, 1998; Leslie & Roth, 1993; Leslie & Thaiss, 1992) proposed that, in addition to the ToMM, false belief success requires an additional executive processing unit, called the "Selection Processor" (SP). By this view, the SP enables the child to attend to false belief, rather than being overburdened by the truth of current reality (Scholl & Leslie, 1999).

Evidence taken in support of this view comes from studies showing that tasks of desire may be as difficult as false belief tasks when the information-processing demands required for success are increased (Leslie & Polizzi, 1998; Moore et al., 1995; Roth & Leslie, 1998). Moreover, support for a more general processing constraint of the SP on false belief performance comes from other tasks that require similar processing requirements as false belief tasks but without the mental state content (Roth & Leslie, 1998; Zaitchik, 1990) and from tasks in which young children's false belief performance is enhanced when the SP processing demands are lowered (Freeman, 1994; Mitchell & Lacohee, 1991; Saltmarsh, Mitchell & Robinson, 1995).

5.0.ii False Belief Failure as a Non-representational Issue

5.0.ii.a The Simulation Theory

Simulation theorists argue against the theory theory's representational deficit hypothesis explanation of false belief failure prior to the late preschool years.

According to this view, representational status does not influence the belief attribution process; rather, the child merely makes use of his or her own representations and off-line decision-making resources. The system is proposed to fail, as in the case of false belief attributions, when the “shifting of frames” does not sufficiently model that of the target agent’s current perspective on reality (Harris, 1992). Developmental increases in mentalising performance throughout the preschool years are explained in terms of children’s increasing powers to use imagination to generate “pretend” inputs for entry into their own decision-making processes (Harris, 1992). By this account, the “perspective shifting” frees the child from his or her own current perception of reality enabling representation of the target agent’s current perspective on reality without interference from the real world. According to the simulation account, young children’s difficulty with false belief attributions prior to 4 years of age is due to the complexity of the perspective shifting required to generate a correct response (Goldman, 1989; Harris, 1996). Harris (1992, 1995) argued that false belief tasks, by design, serve to block the simulation process, as false belief attributions require that the child override his or her own perception of reality to take on the target agent’s current perception of reality. From the simulation view, failure on false belief tasks is due to the complex perspective shifting required by the task, rather than an inability to make mental attributions.

Evidence cited in support of the simulation theory comes from the findings of modified false belief tasks whereby false belief performance has been shown to be facilitated when the solution may be generated at a level of action (Freeman et al., 1994). Modified false belief tasks adopting visual imagery cueing systems have also been shown to have facilitative effects of false belief performance, providing further evidence for the simulation view (Custer, 1996; Mitchell & Lacohee, 1991; Experiment 3, chapter 4).

5.0.ii.b Reality Masking and Executive Control Information-Processing Hypotheses

As overviewed in chapter 1, alternative information-processing explanations support the notion that it is not an underlying difficulty with appreciating the representational nature of mental states, which accounts for false belief failure. Information-processing theorists have explained the developmental changes in mental state attributions throughout the preschool years in terms of increases in *executive functioning*. Mitchell's (1994, 1996) reality masking hypothesis, for example, proposed that the task-demands of false belief tasks may restrict the preschooler's ability to make accurate attributions. Like Leslie's (1994) account, this view proposes that children are predisposed to be drawn to a current stance on reality so that, in face of conflicting realities, such as outdated false beliefs, the child will default to the true state of affairs (Mitchell, 1996). By this view, false belief failure is considered to be a task-specific failure revealing little about young children's representational abilities (Mitchell, 1994, 1996; Robinson, Mitchell, Isaacs & Nye, 1992).

Similarly, Russell (i.e. Russell et al., 1991; Russell et al., 1994) proposed that young children's difficulty with false belief attributions may not be due to a representational understanding deficit; but instead, it may be a result of executive control deficits, specifically executive-inhibition limitations. Russell et al. (1991) proposed that the failure to inhibit a prepotent response may be responsible for young children's tendency to be drawn toward the current state of physical reality without consideration of knowledge relating to mental states.

Support for these information-processing views of cognitive development has come from studies in that children's false belief performance has been shown to be facilitated when the information-processing load has been minimised by the reduction of the salience of physical reality (Mitchell & Lacohee, 1991; Saltmarsh & Mitchell, 1996). Studies showing that, when executive-inhibition demands of tasks are lowered, performance on tasks of deception is enhanced in 3-year-old children

(Russell et al., 1994) also support this view. Moreover, false belief performance has been shown to correlate with tasks of inhibitory control and working memory (Carlson et al., 1998; Hughes, 1998).

5.0.ii.c False Belief Failure and Reasoning Abilities

As seen in chapter 1, other theorists have supported non-representational deficit accounts of mentalising development, proposing that false belief failure may be indicative of a wider difficulty in cognitive reasoning abilities, such as inferring counterfactual situations (Riggs et al., 1998) or using rule-based reasoning (Frye et al., 1995). Riggs et al. (1998), for example, suggested that the occurrence of realist errors on tasks of false belief may be a consequence of the failure to acknowledge the non-mentalistic counter-to-fact situation presented in the scenarios. A false belief scenario is a counterfactual situation because the child is forced to reason about an outdated state of affairs as represented by the protagonist's false belief about the current state of affairs.

In a series of studies, Riggs et al. (1998) investigated the relationship between non-mental counterfactual reasoning and false belief attributions. In *Studies 1-3* of Riggs et al. (1998), standard unexpected transfer Maxi false belief tasks were modified such that children were asked a non-mentalistic question about the counter-to-fact state of the physical state of affairs. For the counterfactual test question, the children were asked to indicate where the transferred object *would* be had it *not* been moved to a new location. This task was designed to require the acknowledgement of a counter-to-fact physical state affairs without the mentalising component of the standard false belief tasks. The findings revealed a strong correlation between young children's performance on the non-mental physical state counterfactual tasks and the standard false belief test question. Riggs et al. (1998) concluded that this finding indicates that the realist bias exhibited by young children on tasks of false belief

extends beyond the belief component and occurs as often on tasks which require a similar acknowledgement of counterfactuality but not an understanding of representations.

In order to address the possibility that children's failure to acknowledge counterfactuals in their study was due to a more general problem with reasoning about alternative realities, counterfactual or not, Riggs et al. (1998) tested children's understanding of *future hypothetical* conditions. Future hypotheticals require neither counter-to-fact reasoning nor mentalistic reasoning. Rather, they do require the suppression of current reality and conditional reasoning about an alternative, possible reality that it is never meant to stand for current reality. Riggs et al. (1998) designed a procedure for future hypothetical attribution whereby children were familiarised with a two-location sorting procedure. Objects on one dimension, such as "papers with drawings", were to be placed in *Location A* and "blank papers" were to be placed in *Location B*. For the future hypothetical test question, the experimenter removed a previously sorted blank page from its correct location (*Location B*) and the child was asked to indicate where the paper should be placed *if* the experimenter were to make a drawing on the page (Correct response: *Location A*). The findings of this study showed that 3-year-old's performance was significantly better on tasks of non-mental future hypothetical reasoning than on non-mental counterfactual statements. Riggs et al. (1998) argued that this findings lends support to the notion that the difficulty lies with the non-mental counter-to-fact situation of the false belief tasks and not an inability to entertain alternative realities simultaneously.

Similarly, Zelazo and Frye (1996) proposed the "cognitive complexity and control theory" of mentalising development. By this view, the increasing abilities to control thought and reflect on knowledge account for mentalising development and false belief success in the later preschool years (Zelazo & Frye, 1996). It is argued

from this position that false belief tasks require similar logical structures and mandate self-reflective knowledge, or higher order non-mentalising related to rule use and false belief success is a result of increasing abilities to reflect on one's own cognitive processing (Zelazo & Frye, 1996). Zelazo and Frye (1996) propose that it is not representational understanding that develops throughout the preschool years but an ability to reflect on knowledge which is used to adequately guide behaviour under conditions of interference, such as reality conflict, as in false belief tasks.

Frye et al. (1995) tested children on a non-mentalising two-dimensional card sorting procedure. The findings showed that false belief performance significantly correlated with the abilities to switch between rules when card sorting. Moreover, the findings revealed that 4-year-old but not 3-year-old children could successfully switch between rules during the card sorting procedure. This inflexibility in rule use among the younger children, along with the correlation between the ability to rule switch and false belief success, led Zelazo and Frye (1996) to conclude that young children have general executive function limitations which result in false belief failure; specifically, that young children are incapable of reflecting upon knowledge.

5.0.iii Representational Status and the Pretence Anomaly

Pretence has been formally defined as “projecting a supposed situation onto an actual situation in the spirit of fun rather than for survival” (Lillard, 1993a, p349). Pretend episodes, like false belief situations, are counter-to-fact situations: both require the suppression of a known-to-be-true reality while simultaneously entertaining an alternative representation of reality (Lillard, 1993b, 1994). In the false belief situation, the child must suppress current knowledge about the true state of affairs (i.e. “that the object has been relocated” or “the box is baited with an unexpected content”) and reason according to an alternative reality (i.e. “the object is in its original location” or “the box contains the expected content”). Similarly, a

pretend episode, such as using a plate as a steering wheel, requires the simultaneous entertainment of two representations: one that suppresses current reality (i.e. “the object is a plate”) and the pretend representation of the counter-to-fact situation, (i.e. “the plate is a steering wheel”) (Lillard, 1994). Paradoxically, pretend play skills emerge around two years prior to that of false belief understanding.

Despite the apparent similarity between pretence and belief abilities, little agreement has been reached in explaining the developmental dissociation in the onset of these capabilities. Before turning to theoretical explanations of pretence development, a brief overview of the development of pretence abilities is provided.

5.0.iii.a The Emergence of Pretence: A Brief Review

Spontaneous pretend play may emerge in young children as early as 18 months of age (Leslie, 1987, 1988). By the second year, young children often show object substitution in pretend play contexts and, by 3 years of age, children demonstrate play episodes with imaginary objects (Overton & Jackson, 1973). Research into young children’s formal understanding of pretence has shown that, by 2 to 3 years of age, children show a firm understanding of both the pretend-real distinction (i.e. Estes, Wellman & Woolley, 1989; Harris, Brown, Whittal & Harmer, 1991; Wellman, & Estes, 1986) and the fantasy-real distinction (Johnson & Harris, 1994). Harris (Harris, Kavanaugh, 1993; Harris, Kavanaugh & Meredith, 1993) conducted a series of investigations into young children’s understanding of various types of pretend episodes. The findings of these studies showed that children as young as 2 years of age were successful in predicting and interpreting the outcomes and consequences of pretend acts. In these studies, the experimenter enacted various pretend episodes, such as pretending to pour tea over a fluffy toy. Children were correctly able to infer that the fluffy toy in the context of that pretend episode would get “wet” as a result of being poured with pretend tea. In another study, children were

presented with various scenarios depicting a “pretending protagonist” (Wellman & Estes, 1986). When asked to indicate if the object of the protagonist’s pretence could be seen or touched by the protagonist, 3- to 5-year-old children were successfully able to negotiate the pretend-real distinction. Similarly, it has been shown that 3-year-old children do not misattribute physical properties to mental images (Estes et al., 1989).

While young children by the age of 3 seem to have considerable understanding of pretence and pretend acts, they consistently have trouble with recognising and attributing false beliefs. Several studies have compared young children’s understanding of pretence and belief understanding. Gopnik & Slaughter (1991) found that 3-year-olds succeeded in recalling their earlier pretences but failed to recall their earlier false beliefs. Similarly, Peskin (1996) found that 3-year-olds could successfully recognise that, in a fairy tale story, a wolf dressed as “Grandmother” was *pretending* to be Grandmother; but they were unable to recognise that Little Red Riding Hood would *think* that the wolf was Grandmother.

5.0.iv The Representational Status Pretence

5.0.iv.a Pretence as Full-blown Representational Understanding

Leslie (1987, 1988) first proposed the notion that pretend play as early as 18 months requires the use of sophisticated representational capabilities. Leslie (1987) attributed what he termed *M-representational* capacities to young children’s pretend play. According to this view, young children are endowed with an innate, domain-specific mentalising mechanism, called the ToMM, which predisposes young children and infants to attend to and understand the behaviour of agents (Leslie, 1994b). The understanding of pretence, by this account, is enabled by a predetermined set of informational relations of the ToMM. The ToMM dictates that the children handle pretence according to M-representational understanding. By this account, the ability to understand pretence from a very early age serves to avoid a situation of

“representational abuse”. That is, pretence requires the pretender to represent another representation of a counterfactual state of affairs. To do so, the ToMM enables the pretend representations to be “quarantined off” from *primary representations* via the use of second-order, *decoupled representations*. If, for example, a child was to pretend that a plate was a steering wheel, the plate, as the true state of affairs, forms the primary representation. This representation would be copied into another context “decoupled” from reality and referent in such a way that the truth and existence relations are suspended as follows:

M-representation = Agent (I) Informational relationship (Pretend)

Toward Referent (of the plate) Truth Statement (that it is a steering wheel).

By this account, the M-representational capacity is a type of representational “anchoring” which permits the child to reason about two alternative realities without interference from the true state of reality (Leslie, 1987). The *decoupled representations* are said to be “anchored” to the *primary representations* in such a way that the child may hold two divergent interpretations of the reality. Leslie & Roth (1993) ascribe the developmental increase in mentalising understanding, namely the dissociation between pretence and false belief understanding throughout the preschool years, to the innate growth of the modular ToMM and executive selection processor mechanisms (SP). By this account, pretend play at 2 years of age requires only ToMM but more complex false belief tasks require the extra information-processing provided by the SP, which is not in place until the fourth year.

5.0.iv.b Pretence as Partial Representational Understanding

Theory theorists generally support the notion that early pretence abilities suggest early mentalistic understanding; however, most are more conservative in how much representational understanding may be attributed to children at 2 years of age

(Flavell, 1988; Forguson & Gopnik, 1988). Gopnik and Slaughter (1991) argued that the understanding of pretence emerges early on in development because, unlike false belief understanding, pretence attributions do not require an understanding of how representations are related to reality. By this view, beliefs need only *represent* the world, although they may, but not necessarily, (e.g. as in the case of false beliefs) reflect the true state of the world. Young children understand that pretend acts are never meant to stand for reality and therefore pretend acts do not cause the children interpretative difficulties. Taken as evidence in support of this view, Flavell, Flavell and Green (1987) found children's ability to appreciate the pretend-real distinction emerges earlier than the ability to appreciate the appearance-reality distinction. Flavell et al. (1987) argued that belief understanding requires the recognition that the internal mental representations of external stimuli are to be distinguished from the stimuli themselves. In the pretend-real situation there are two representations of the same stimuli, the real (i.e. object is a plate) and the pretend (i.e. plate is now a steering wheel); however, the appearance-reality situation requires the same stimuli to represent two different things, not in the real world, but in the mind (i.e. appears to be a steering wheel, can be a steering wheel or not a steering wheel).

Custer (1996) supported the notion that young children can understand some representational aspects of mentalising. Custer (1996) presented 3- and 4-year-old children with various mental state scenarios in which two alternative thought bubbles were presented over the protagonist's head. The children were asked to select the picture that indicated what the protagonist was pretending, remembering, or thinking. One picture showed the mental representation (false belief) held by the character and the other picture showed the current reality of the situation. The findings revealed that 3-year-olds did significantly better on the pretence and memory questions than on false belief attributions. Custer (1996) suggested that preschool children can

understand that a single referent can give rise to two contradictory mental representations, but only when it is not meant to stand for a current reality. On this account, preschool false belief failure is due to the inability to reason concurrently about two meant-to-be true representations of reality.

5.0.iv.c Pretence as Non-Representational “Acting-as-If”

Alternative representational understanding views of pretence propose that young children need not entertain pretence *as* mental representations for successful negotiation. Rather, very young children may merely be “acting-as-if” a pretend episode were true, (Harris & Kavanaugh 1993, Lillard, 1993; Perner, 1991). By this account, children do not recognise pretence as a representation of the world but rather act in a way “as-if” the pretend situation might be true (Perner, 1991). Pretend play, by this view, is a kind of counterfactual situation whereby the child can keep track of false propositions in relation to the alternative true state of affairs by “acting-as-if” the proposition were true while being aware it is false. Perner (1995) maintained that the young child cannot distinguish between “beliefs” on the one hand and “pretences” on the other. That is, beliefs and pretences are indistinguishable and misrepresentation is never acknowledged correctly. This blurring of pretence and belief by the young child is what Perner, Baker and Hutton (1994) called *prelief*.

Lillard (1993b) supported the notion that pretence skills are independent of representational understanding, maintaining that acts of pretence differ from thinking or remembering in that they are usually accompanied by overt physical actions. By this view, children come to recognise pretences in terms of non-mental characteristics (Lillard, 1994). Evidence in support of the “acting-as-if” notion as a lack of formal understanding of pretence as a mental phenomenon comes from a study in which young children aged 3 to 5 years of age described acts of pretending as something done with *body* instead of *mind* (Lillard, 1993b). In one study, young children

appeared to believe that the story protagonist mistakenly attempting to feed a rabbit that had been removed from a box was *pretending* to feed the rabbit (Perner et al., 1994). In another study, Rosen, Schewebel and Singer (1997) found that, while most 4-year-old children could correctly distinguish between real and pretend actions, it was not until around age 5 that they correctly indicated a pretender's beliefs or thoughts about an act of pretence. For example, Rosen et al. (1997) showed young children clips of a familiar cartoon character engaging in pretend acts, such as pretending a park bench to be an aeroplane. Rosen et al. (1997) found that children were correctly able to indicate that the character was engaging in an act of pretence but were unable to distinguish whether the character actually believed the bench to be an aeroplane. Moreover, in another study, preschool children incorrectly indicated that an individual hopping like a rabbit was pretending to be a rabbit even when the individual was known to be ignorant of the fact the rabbits hop (Lillard, 1993b). The findings of these studies suggest that children read an individual's action and ascribe his or her behaviour as "acting-as-if" a certain state of affairs were true without any consideration of his or her current mental state.

From a developmental simulation perspective, Harris (1992) agreed that pretence does not require a special understanding of representational capacities. In support of the "acting-as-if" notion, Harris (1994) argued that pretence to a young 2-year-old child is special form of *activity* rather than any mentalistic function. The simulation theory posits that pretence attributions, like belief attributions, are off-line events. As such an act of pretence does not require a representational understanding of pretending, just the entertainment of a representation of the pretend episode (Currie, 1998). Children, by this view, are not considered to be sensitive to their own or others mental states of pretence but are sensitive to what pretending *is*. From this account, children automatically default to imagining the pretence situation, as a non-

real situation whereas for false beliefs the child must *override* a default setting which states that “reality is true” (Currie, 1998).

Harris (1991, 1994) maintained that the understanding and the ability to engage in pretend play is a precursor component for the processes of mental simulation. According to this view, the simulation process requires two steps: imagining a particular set of desires or beliefs and imagining what thoughts and actions accompany those desires or beliefs (Harris, 1991). The ability to imagine another individual’s current perception of reality by “perspective shifting” exploits the ability to make use of “pretend” inputs based on the imaging perspective of the target agent. It is hypothesised that, through an implicit process called “flagging” (Harris, 1991), children mentally represent a pretend situation without interference from the true state of the world. By this view, an implicit mental marker (“flag”) tags information about what is to be irregularly held as true in the pretend episode (i.e. “the plate is [now] a steering wheel”). Flagging is proposed to be episode-based so as not to overgeneralise to other contexts (i.e. “the plate will only remain a steering wheel for this particular episode”). According to this view, through the process of pretence, the representation is freed from its referent by the processes of “flagging” and the child accepts that real world empirical knowledge does not apply to the pretend episode, thereby allowing deductive reasoning within the pretend episode (Harris, 1994).

Support for the simulation theory comes from research showing that, when children are asked to reason about syllogisms or hypothetical situations under pretend or fantasy conditions, performance is facilitated (Dias & Harris, 1988; Hawkins, Pea-Roy, Glick & Scribner, 1984; Kuczaj 1981). Dias and Harris (1988), for example, presented children with syllogisms such as: “all cats bark, Rex is a cat, does Rex bark?”. For some of the syllogisms the children were encouraged to use pretence to

help solve the tasks by instructing them to pretend as if they were on another planet.

Dias and Harris (1998) found that children performed significantly better on the fantasy and pretend type questions than on the standard syllogisms.

5.0.iv.d False Belief Attributions Under Conditions of Pretence

Recently, researchers have begun to investigate the impact of pretence on young children's false belief understanding. The findings using "pretend" false belief tasks suggest that false belief understanding, at least under some conditions of pretence, may be bolstered. In one study, Hickling, Wellman and Gottfried (1997) adapted the standard unexpected transfer Maxi false belief task by replacing the location change with a change of pretence. In this paradigm, a protagonist pretended that, for example, his glass was full of chocolate milk. Upon the exit of the protagonist, the experimenter encouraged the child to pretend that the glass was empty. Hickling et al. (1997) found that 78 percent of 3-year-olds successfully predicted that the protagonist would think the glass was full of chocolate milk but only 25 percent of these children were successful on a standard unexpected transfer task. Cassidy (1998) successfully replicated this finding. However, in the presence of a reality tracer, that is pretending about a real object that was present, performance in the pretend context was significantly lower. This finding led Cassidy (1998) to conclude that young children's false belief performance may be facilitated within the context of pretence however, this effect may only hold when the tendency for a reality bias is reduced.

5.0.v Aims

The present study was designed to explore further the relationship between false belief, reality reasoning, and pretence. The first aim was to compare young children's performance on tasks of false belief, non-mental counterfactual situations and future hypothetical reasoning. A series of carefully controlled testing scenarios

designed to assess directly the potential dissociations in performance between the three tasks were incorporated into a single testing paradigm. Riggs et al. (1998) made comparisons between these concepts through a series of studies; as such, all three capabilities were not compared in one study. It was the aim of this study to extend the findings of Riggs et al. (1998) through the use of a single testing paradigm that assesses more directly potential associations and dissociations in performance of these abilities.

Based on the findings of Riggs et al. (1998), it was predicted that the counter-to-fact situation involved in the tasks would result in a correlation between false belief and non-mental counterfactual test questions. This finding would show support for the notion that it is not the representational component that is difficult about the false belief but rather false belief tasks involve reasoning about a counterfactual state of affairs. Also based on the findings of Riggs et al. (1998), it was predicted that false belief and counterfactual reasoning test questions (because of their shared counter-to-fact component) would be more difficult than future hypothetical tasks. Future hypothetical situations, unlike false belief and counterfactual situations, do not require reasoning about a counter-to-fact situation meant to stand for current reality, rather, about a *possible* alternative reality as the future is unknown. Successful future hypothetical reasoning would provide evidence against the notion that children are incapable of entertaining alternative representations of current reality.

The second aim of this study was to investigate the ability of preschool children to entertain counterfactual, false belief and future hypothetical situations while embedded in the context of pretence. Recent investigations have shown preliminary evidence to suggest that false belief performance may be bolstered in young children when presented within a pretend context (Cassidy, 1998; Hickling et al., 1997). Improved false belief success under pretence conditions would provide

further evidence against the notion that young children's difficulty with false belief tasks is caused by a representational understanding deficit. That is, children lacking a representational understanding of mind would be expected to fail false belief attributions regardless as to whether they are presented under conditions of pretence.

In order to test this notion two pretence conditions, one pretence with reality tracer condition and one pretence with no reality tracer were included in the present study. In these conditions, children were asked to "pretend" or "imagine" the events depicted in the various false belief, counterfactual and future hypothetical situations. Based on the facilitative effects of pretence on reasoning found in prior investigations (Cassidy, 1998; Dias & Harris, 1988; Hickling et al., 1997), it was predicted that the pretend context would also facilitate false belief and counterfactual reasoning. According to Mitchell's (1994) reality masking hypothesis and Russell et al.'s (1991) executive-control deficit hypothesis views, young children's difficulty with false belief tasks lies with their inherent bias toward current reality and a failure to inhibit their current knowledge of the true state of affairs. By these information-processing views, children respond to false belief attributions as if they were questioned about the reality of the current situation, with apparent disregard of protagonist's knowledge of the situation. If pretence as a reduction of the reality load for executive processing serves to facilitate false belief and counterfactual reasoning performance, further support would be shown for these information-processing accounts of false belief failure.

A third aim of this study was to assess the impact of reality tracers on young children's pretence performance. Recent evidence has shown that pretence may bolster young children's false belief performance, although the facilitative effects may be diluted in the presence of a strong reality tracer (Cassidy, 1998). In Cassidy's (1998) "reality-tracer" procedure, children were asked, in the absence of a

protagonist, to change the object substitution pretence (i.e. pretending a banana is a telephone) back to a pretence involving the object's true identity (i.e. pretending the banana is a banana). It is argued that the pretending of an object's true identity may not be representative of a true pretence of the *object*, and more of an instance of playing with the object. In this study, a second pretence condition included a physical reality tracer for the pretence; however, unlike the Cassidy (1998) procedure, children were asked to pretend *about* the object and not about its identity. For example, as part of the false belief scenario in the reality tracer condition the children were asked to pretend that a real pair of shoes was dirty. In contrast in the no reality tracer condition the shoes themselves were imaginary. If children show a dissociation in performance between the standard pretence condition and this reality tracer pretence condition, evidence would be shown in support for the notion that children have a predisposition to be drawn to current reality. If children pass false belief and counterfactual questions under both conditions of pretence but fail the standard test questions, then evidence would be shown in support for the notion that it is something other than the bias toward reality that is responsible for failure under standard conditions.

5.1 Method

5.1.i Design

5.1.i.a Test Questions: Future Hypothetical, Counterfactual and False Belief

A between-subjects design was adopted for this study. The dependent variables were children's performance on three test questions: future hypothetical, counterfactual and false belief. All test questions were based on three scenarios (to be referred to as: *dirty shoes*, *dough* and *paper* scenes). Only one test question was asked per scenario so that, for any one scenario, a child would respond to either a future hypothetical, counterfactual or false belief test question. All children responded to all three types of test questions. The order of presentation of the test

questions and scenario presentation was counterbalanced across children according to a “Latin-squares” design. For example, for each of the three scenarios, one third of the sample was asked to respond to a future hypothetical question pertaining to the events of that scenario, one third was asked the counterfactual question and one third was asked the false belief question about the events of that scenario. Similarly, the order of presentation of the test questions was counterbalanced across children so that one third of the sample was tested on the future hypothetical test question first, one third on the counterfactual and one third received false belief test question first.

All three testing scenarios entailed a two-location sorting game based, in part, on the procedures of Riggs et al. (1998). For example, in the *dirty shoes scene*, the children were required to sort pairs of soiled shoes into a box called the “dirty shoes box” and pairs of unsoiled shoes into a box called “clean shoes box”. The false belief test questions were modelled on the standard unexpected transfer Maxi task (Wimmer & Perner, 1983). For the *dirty shoes scenario*, for example, the protagonist was made to correctly place her soiled shoes in the “dirty shoes box” and then exit the scene. During the protagonist’s absence the shoes were cleaned by the experimenter and moved to a second location, the “clean shoes box”. The false belief test question entailed the prediction of where the protagonist, upon her return, would search for shoes (correct response: initial location in the “dirty shoes box”).

The counterfactual test question was also based on the procedures of Riggs et al. (1998). For this question, again, the protagonist was made to place her soiled shoes in the “dirty shoes box” before exiting the scene. The experimenter removed the shoes from the “dirty shoes box” and cleaned the shoes. Then the experimenter placed the shoes in the second location, the “clean shoes box”. The child was asked to report which location the shoes *would* be in had the experimenter *not* cleaned the shoes (correct response: “dirty shoes box”).

The future hypothetical test question was also based on the procedures of Riggs et al. (1998). In the *dirty shoes scene*, for example, as before, the protagonist placed her soiled shoes in the “dirty shoes box” prior to exiting the scene. Again the experimenter removed the shoes in the protagonist’s absence but rather than cleaning the shoes, the experimenter *mimed* cleaning the shoes in this condition. The child was asked to indicate in which location the shoes *would* be placed, if the shoes were to be cleaned (correct response: “clean shoes box”).

5.1.i.b Group Assignment

Group assignment was an independent variable with three levels: *standard*, *pretence-no reality tracer* or *pretence-reality tracer*. The testing scenarios for each of the three conditions were designed to be identical in structure, differing in only one critical respect. The children in the *standard condition* were told about and witnessed the various manipulations to the target object (i.e. physical presence of “dirty shoes” and the acts of cleaning and location change of the shoes). The children in the two pretence conditions (*pretence-no reality tracer* and *pretence-reality tracer*), however, were asked to pretend along with the experimenter the events of the scene. The two pretence conditions, therefore, differed from the *standard condition* in that the false belief, counterfactual and future hypothetical test questions were based on shared pretend acts between the child and the experimenter. In the first of the two pretence conditions, for example the *pretence-reality tracer condition* for the *dirty shoes scene*, the children were asked to imagine or “pretend” that the shoes were soiled. In this condition, the child was required to pretend along with the experimenter the cleaning of the shoes (for the counterfactual and false belief questions only).

The *pretence-no reality tracer* differed from the *pretence-reality tracer* condition in that, along with pretending that the shoes were soiled, the scenes were also based on pretend shoes. That is, the shoes were never physically present during

the scene; rather, they were the objects of shared pretence between the child and experimenter. The events and various manipulations (i.e. cleaning of shoes) and location changes (i.e. “dirty shoes box” to “clean shoes box”) were also based in pretence.

5.1.ii Participants

The participants were 60 children recruited from two nursery schools in London. All of the children were native English speakers. The children were of mixed ethnicity, with approximately 50 percent Caucasian and 50 percent from ethnic minority groups. There were 20 children (7 boys, 13 girls) in the *standard* group, 20 children in the *pretence-no reality tracer* group (9 boys, 11 girls) and 20 children in the *pretence-reality tracer* group (11 boys, 9 girls). The ages of the children in the *standard* condition ranged from 3:10 (years: months) to 4:4 (years: months) with a mean age of 3:10 (years: months) (standard deviation: 4.5 months). The age range of the children in the *pretence-no reality tracer* condition was 3:11 to 4:1 with a mean age of 3:9 (standard deviation of 5.4 months). The *pretence-reality tracer* group's ages ranged from 3:10 to 4:0 with a mean age of 3:6 months (standard deviation: months). A one-way analysis of variance showed that there was no between-group difference in age, ($p > 0.1$, two-tailed).

5.1.iii Materials

For each of the three scenarios (*dirty shoes*, *paper*, and *dough*) two plain, open-topped boxes measuring 15 X 6 X 6 centimetres were used. A different fluffy toy (6 centimetres in height) was used as the protagonist for each of the three scenarios. The *paper scene* utilised seven pieces of paper; each 6 X 4 centimetres. Four of the papers were blank and the remaining three pieces portrayed drawings of stick figure men. Seven pairs of Ken Barbie Doll Shoes (1 X 0.5 centimetres) were used for the *dirty shoes scene*. Four of the pairs of shoes were soiled with “mud”

generated by dipping the shoes into brown finger paint. For the *dough scene*, plasticine was used to make four round balls measuring 1.5 centimetres in diameter and three long pieces of 6 centimetres in length.

5.1.iv Procedure

The children were asked if they would like to play some games with the experimenter. All children were tested individually by the same experimenter at a secluded table located in the nursery. All children were introduced to a sorting control warm-up phase for each of the three different scenarios prior to administration of the corresponding testing phases.

5.1.iv.a Control Warm-Up Procedure

The warm-up phases were based on a two-location sorting procedure developed by Riggs et al. (1998). *Table 5.1* shows an example control warm-up script from the *dirty shoes scene*. The control warm-up phases for each of the three scenarios were identical in structure and designed to ensure that the children had the prerequisite skill of sorting items by category into two boxes required for the testing phases (clean and dirty shoes for the *dirty shoes scene*; long and round dough for the *dough scene*; paper with drawings and no drawings for the *paper scene*). The children were introduced to the game and materials and were taken through a total of four category identification and four sorting control trials prior to the administration of the test question for each scenario. If the child failed to respond correctly to any of the control trials, the child was reintroduced to the materials and script and the procedure was repeated until success on all four trials of each type was demonstrated.

Table 5.1: Example scenario from the control warm-up phase.

(Two pairs of doll shoes are placed in front of the child) <i>"Here are some shoes. Some of the shoes are dirty like these."</i> (Experimenter points to soiled shoes) <i>"And some of the shoes are clean, like these."</i> (Experimenter points to clean shoes) <u>Category Control Question:</u> (Experimenter points to a pair of shoes) <i>"Are these shoes dirty?"</i> (In total, four control questions of this type were given so that "Yes" was the correct response for two questions and "No" was the correct response for the remaining two questions. If incorrect responses were given at this stage, the children were reintroduced to the materials and the four control questions until correct responses were given). (Two boxes are placed on the table) <i>"Here are two boxes. This one is for dirty shoes and this one is for clean shoes."</i> (The child was then asked to correctly identify each box) <i>"When we play this game, if the shoes are clean we put them in the 'clean shoes box'. Only clean shoes go into the 'clean shoes box'. NO dirty shoes go in the 'clean shoes box'. No way. All clean shoes go in the 'clean shoes box'. Here are some clean shoes so they go in the 'clean shoes box', like this."</i> (Experimenter places shoes in the "clean shoes box") <u>Sorting Control Question:</u> (Experimenter points to a pair of shoes) <i>"Which box do these shoes go into?"</i> (In total, four control questions of this type were given so that the "dirty shoes box" was the correct response for two questions and the "clean shoes box" was the correct response for the remaining two questions. If incorrect responses were given at this stage, the children were reintroduced to the materials and the four control questions until correct responses were given).
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5.1.iv.b Testing Phase

Following the completion of the control warm-up phase, the testing phase began. *Table 5.2* displays example introduction scripts for the *standard*, *pretence-no reality tracer* and *pretence-reality tracer* conditions (See *Appendix VII* for introduction scripts for remaining two scenarios). Children in the *standard* group were shown the materials and the children in the two pretence conditions were asked to pretend with the experimenter specific aspects of the situations. In the *pretence-no reality tracer* condition, the target object and various manipulations were based in pretence, while in the *pretence-reality tracer* condition the current physical state of the target object and the manipulations were pretence based. Children in the two pretence conditions were also asked two pretence control questions to ensure that they were pretending according to the experimenter's instructions (See *Table 5.2* for script). Following the introduction to the scenario, the test question was administered. *Table 5.3* shows example false belief scripts for the three conditions. *Table 5.4* shows the test question scripts for the counterfactual questions for each of the three conditions and *Table 5.5* shows the future hypothetical scripts (See *Appendix VII* for scripts and test questions for the two remaining scenarios).

Table 5.2: Example introduction scripts for standard, pretence-no reality tracer and pretence-reality tracer conditions (*dirty shoes scene*).

Standard Group

"Now let's play this game with Michelle. Michelle knows how to play this game, it is her favourite game. Michelle has some shoes that are dirty. Michelle is going to tidy up so she puts the dirty shoes in the 'dirty shoes box'.

Now Michelle is going to go to sleep in my bag."

(Exit Michelle)

"While Michelle is asleep in my bag let's take the dirty shoes out of the 'dirty shoes box'."

Pretence-No Reality Tracer Group

"Now let's play this game with Michelle. Michelle knows how to play this game, it is her favourite game. Let's pretend that Michelle has some shoes. The pretend shoes are dirty."

Pretence Control Questions

"Are you pretending with me?"

"Are the pretend shoes dirty or clean?"

(If incorrect responses are given for either question the child is asked again to pretend by imagining in his or her head that there are some pretend shoes.

Procedure is repeated until correct responses are given)

"Michelle is going to tidy up so she puts the pretend dirty shoes in the 'dirty shoes box'. Now Michelle is going to go to sleep in my bag."

(Exit Michelle)

"While Michelle is asleep in my bag let's take the pretend dirty shoes out of the 'dirty shoes box'."

Pretence-Reality Tracer Group

"Now let's play this game with Michelle. Michelle knows how to play this game, it is her favourite game. Michelle has some shoes.

The shoes are dirty."

"Michelle is going to tidy up so she puts the dirty shoes in the 'dirty shoes box'.

Now Michelle is going to go to sleep in my bag."

(Exit Michelle)

"While Michelle is asleep in my bag let's take the dirty shoes out of the 'dirty shoes box'."

Table 5.3: Example false belief test and control questions for standard, pretence-no reality tracer and pretence-reality tracer conditions (*dirty shoes scene*).

Standard Group

(Experimenter cleans shoes)

"Let's clean the mud from the shoes. Are the shoes clean? So I'll put them in the 'clean shoes box'. Now Michelle wakes up from her nap and comes back for her shoes".

Test Question: *"Which box will Michelle look in first for her shoes?"*

Correct Response: *"dirty shoes box"*

Control Question: *"Which box did Michelle leave her shoes in at the beginning of the story?"*

Correct Response: *"dirty shoes box"*

Pretence-No Reality Tracer Group

(Experimenter mimes cleaning pretend shoes)

"Let's pretend to clean the mud from the pretend shoes. Are the pretend shoes pretend clean? So I'll put them in the 'clean shoes box'. Now Michelle wakes up from her nap and comes back for her pretend shoes".

Test Question: *"Which box will Michelle look in first for her pretend shoes?"*

Correct Response: *"dirty shoes box"*

Control Question: *"Which box did Michelle leave her pretend shoes in at the beginning of the story?"*

Correct Response: *"dirty shoes box"*

Pretence-Reality Tracer Group

(Experimenter mimes cleaning pretend mud from shoes)

"Let's pretend to clean the mud from the shoes. Are the shoes pretend clean? So I'll put them in the 'clean shoes box'. Now Michelle wakes up from her nap and comes back for her shoes."

Test Question: *"Which box will Michelle look in first for her shoes?"*

Correct Response: *"dirty shoes box"*

Control Question: *"Which box did Michelle leave her shoes in at the beginning of the story?"*

Correct Response: *"dirty shoes box"*

Table 5.4: Example counterfactual reasoning and control questions for standard, pretence-no reality tracer and pretence-reality tracer conditions (*dirty shoes scene*).

Standard Group
(Experimenter cleans shoes)

*"Let's clean the mud from the shoes. Are the shoes clean?
So I'll put them in the 'clean shoes box'."*

Test Question: *"If I had not cleaned the shoes which box would the shoes be in?"*

Correct Response: *"dirty shoes box."*

Control Question: *"Which box did Michelle leave her shoes in at the beginning of the story?"*

Correct Response: *"dirty shoes box."*

Pretence-No Reality Tracer Group
(Experimenter mimes cleaning shoes)

*"Let's clean the pretend mud from the pretend shoes. Are the pretend shoes clean? So
I'll put them in the 'clean shoes box'."*

Test Question: *"If I had not cleaned the pretend mud from the pretend shoes which box would the pretend shoes be in?"*

Correct Response: *"dirty shoes box"*

Control Question: *"Which box did Michelle leave her pretend shoes in at the beginning of the story?"*

Correct Response: *"dirty shoes box"*

Pretence-Reality Tracer Group
(Experimenter mimes cleaning pretend mud from shoes)

*"Let's pretend to clean mud from the shoes. Are the pretend shoes clean? So I'll put
them in the 'clean shoes box'."*

Test Question: *"If I had not pretended to clean mud from the shoes which box would the shoes be in?"*

Correct Response: *"dirty shoes box"*

Control Question: *"Which box did Michelle leave her shoes in at the beginning of the story?"*

Correct Response: *"dirty shoes box"*

Table 5.5: Example future hypothetical reasoning and control questions for standard, pretence-no reality tracer and pretence-reality tracer conditions (dirty shoes scene).

Standard Group

(Experimenter picks up shoes and asks test question)

Test Question: *"If I clean the shoes which box will the shoes be in?"*

Correct Response: *"clean shoes box."*

Control Question: *"Which box did Michelle leave her shoes in at the beginning of the story?"*

Correct Response: *"dirty shoes box."*

Pretence-No Reality Tracer Group

(Experimenter mimes cleaning shoes)

Test Question: *"If I pretend to clean the pretend mud from the pretend shoes which box will the pretend shoes be in?"*

Correct Response: *"clean shoes box"*

Control Question: *"Which box did Michelle leave her pretend shoes in at the beginning of the story?"*

Correct Response: *"dirty shoes box"*

Pretence-Reality Tracer Group

Test Question: *"If I pretend to clean the mud from the shoes which box will the shoes be in?"*

Correct Response: *"clean shoes box"*

Control Question: *"Which box did Michelle leave her shoes in at the beginning of the story?"*

Correct Response: *"dirty shoes box"*

5.2 Results

All children were scored on a pass/fail criterion for all of the test questions, future hypothetical, counterfactual and false belief. Children's responses were scored as fail if they answered incorrectly or inappropriately to any test or control question, or if no response was given (e.g. "I don't know").

5.2.i Between-Group Differences in Performance

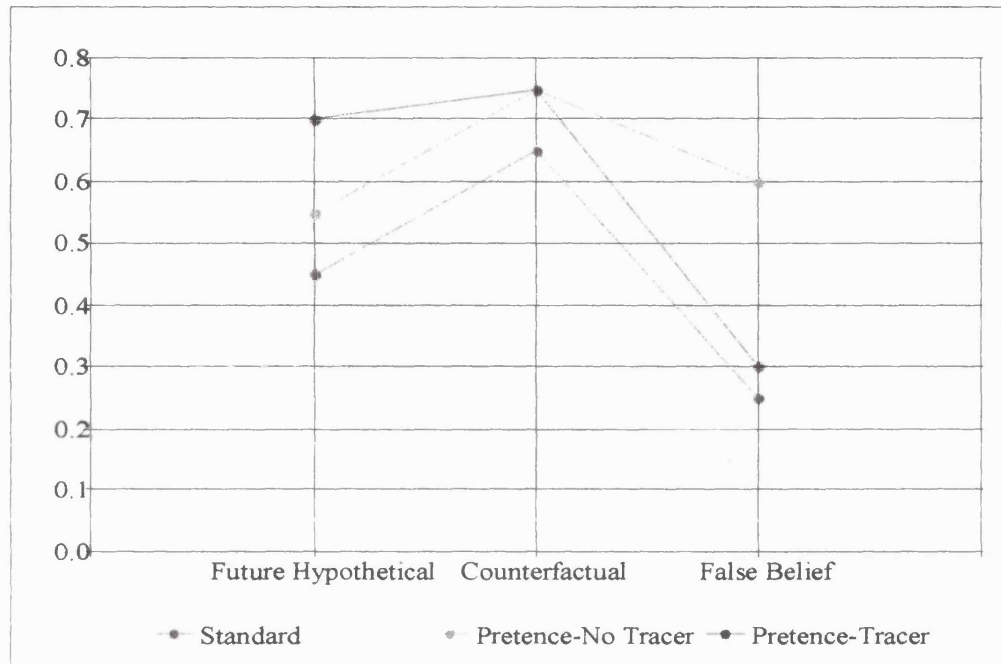
5.2.i.a Future Hypothetical Performance

Table 5.6 shows the number of children in each of the three conditions passing the three test questions (See Figure 5.1). As can be seen in the table, 9 out of 20 children from the *standard* group, 11 out of 20 from the *pretence-no reality tracer* group and 14 out of 20 children from the *pretence-reality tracer* group demonstrated success on the future hypothetical test question. A chi-squared analysis revealed that there was no significant difference in the proportions of children from the three groups passing this test question, ($\chi^2(2, N = 60) = 2.58, ns$).

Table 5.6: Number of children in the standard, pretence-no reality tracer and pretence-reality tracer conditions passing each of the test questions.

<u>Test Question</u>	Standard Group	Pretence-No Tracer Group	Pretence-Tracer Group
<i>Future Hypothetical</i> (n=20)	9 (45%)	11 (55%)	14 (70%)
<i>Counterfactual</i> (n=20)	13 (65%)	15 (75%)	15 (75%)
<i>False Belief</i> (n=20)	5 (25%)	12 (60%)	6 (30%)

Figure 5.1: Percentage of children from the standard, pretence-no tracer and pretence-tracer conditions passing each of the test questions.



5.2.i.b Counterfactual Reasoning Performance

As can be seen in *Table 5.6*, performance of the three groups on the counterfactual test questions was similar across the three conditions (See also *Figure 5.1*). In the *standard* group 13 out of 20 children passed this task and 15 out of 20 children in both the *pretence-no reality tracer* and *pretence-reality tracer* groups were successful on the task. A chi-square analysis confirmed that there was no significant between-groups difference the proportion of children passing this task, ($\chi^2(2, N = 60) = 0.66, ns$).

5.2.i.c False Belief Performance

On the false belief test question, the *standard* group and the *pretence-reality tracer* group performed similarly with 5 out of 20 children from the *standard* group and 6 out of 20 of the children *pretence-reality tracer* group passing this tasks (See *Table 5.6* and *Figure 5.1*). A considerably greater number of children, 12 out of 20,

from the *pretence-no reality tracer* group were successful on the false belief question. A chi-square analysis showed that the proportion of children passing this task differed significantly between groups, ($\chi^2(2, N = 60) = 6.06, p < 0.05$). *Post-hoc* contrasts adopting a Bonferroni corrected alpha value of 0.025 revealed that the *pretence-no reality tracer* group significantly outperformed the *standard* group on the false belief question, ($\chi^2(1, N = 40) = 5.01, p < 0.025$). The difference approached, but did not reach, significance for the *pretence-reality tracer* group and *pretence-no reality tracer* group, ($\chi^2(1, N = 40) = 3.64, p < 0.06$) on the false belief question.

5.2.ii Cross-Task Differences in Performance

In the *standard* group, only 5 out of 20 children demonstrated success on the false belief test question; however, a considerably greater number of children in this group passed the counterfactual test question, with 13 out of 20 passing. Future hypothetical performance fell in the middle for the *standard* group, with 9 out of 20 the children demonstrating success on this task (See *Table 5.6*). According to Howell (1997, p155), the use of an *a priori* approach with chi-square analyses requires that the predicted pattern of results must be observed in order to reject the null hypothesis. It was predicted that because of its lower representational processing demands, the future hypothetical performance of the *standard* group would be significantly easier than both counterfactual and false belief reasoning (which were predicted to be of equivalent difficulty because of their common counterfactual nature). This pattern of results was not observed and therefore the null hypothesis cannot be rejected. Thus, it must be concluded that there is no significant difference between the *standard* group's performance on these test questions (despite significant $\chi^2(2, N=20) = 7.39, p <$

0.05¹⁵). A series of Pearson's phi correlations adopting a Bonferroni corrected alpha value of .0056 confirmed that there was no significant association between performance on any of the tasks (future hypothetical, counterfactual and false belief) for any of the groups (See *Table 5.7* for phi coefficients).

Table 5.7: Phi coefficients for each of the three conditions for future hypothetical, counterfactual reasoning and false belief test questions.

	False Belief-Future Hypothetical	False Belief-Counterfactual	Counterfactual-Future Hypothetical
<i>Standard Group</i>	0.17	0.18	0.24
<i>Pretence-No Reality Tracer Group</i>	0.08	0	0.41
<i>Pretence-Reality Tracer Group</i>	0.19	0.13	0.13

In order to assess the combined ability of future hypothetical and counterfactual reasoning to predict false belief performance regardless of condition, a hierarchical logistic regression was performed on the data. Condition was entered as a covariate in the first block of the regression equation and counterfactual and future hypothetical performance were entered in the second block of the equation. According to the Wald criterion, condition predicted a unique proportion of the variance in false belief performance, (Wald (2, 58) = 5.87, $p < 0.05$). The inclusion

¹⁵Regardless of the a priori approach, post hoc contrasts adopting a Bonferroni corrected alpha value of 0.016 confirmed no significant differences between the number of children passing and the number of children failing any of the questions (false belief/counterfactual: sign test 4:6, ($p < 0.02$), false belief/future hypothetical: sign test 3:9, ($p > 0.1$), counterfactual: future hypothetical: 7:5, ($p > 0.1$)).

of future hypothetical and counterfactual performance did not increase the predictive power of the regression equation, (Wald (2, 58) = 1.046, ns). That is, while condition predicted false belief performance, when condition is held constant, future hypothetical and counterfactual reasoning did not predict false belief performance.

5.3 Discussion

The first aim of this study was to compare young children's performance on standard tasks of false belief, non-mental counterfactual situations and future hypothetical reasoning. Riggs et al. (1998) found that the children in their study performed significantly better on future hypothetical questions than on counterfactual test questions. Moreover, Riggs et al. (1998) found counterfactual and false belief performance to be significantly correlated. Riggs et al. (1998) concluded from the children's success on future hypotheticals that false belief failure in the preschool years is not likely to be a consequence of difficulty in reasoning conditionally about alternative realities and is more likely to be due to a broader difficulty entertaining counter-to-fact states of affairs, both of which are required for false belief and counterfactuals. Based on these prior findings, performance on the future hypothetical reasoning test questions was expected to be significantly greater than both the counterfactual and false belief performance. Furthermore, it was predicted that false belief and counterfactual reasoning test questions (but not future hypothetical questions) would correlate because of their shared counter-to-fact components.

The findings of the present study, however, were not in-line with either of these predictions. In this study, children's performance on standard tasks of false belief, counterfactual and future hypothetical reasoning were of equal difficulty. Although the procedures of the present study were based on the methods developed by Riggs et al. (1998), their findings were not replicated.

In contrast to the findings of Riggs et al. (1998) counterfactual reasoning performance was relatively high across all groups in this study. The *standard* group demonstrated a 65 percent pass rate and 75 percent of the children in both the *pretence-no reality tracer* and *pretence-reality tracer* groups passed this task. Children's performance was much lower (except in the *pretence-no reality tracer* group) on the false belief task, with 25 percent of the *standard* group and 30 percent of the *pretence-reality tracer* group passing. It is argued that these findings do not show support for Riggs et al.'s proposal that young children's difficulty with false belief tasks lies in general difficulties with counterfactual reasoning. The high counterfactual reasoning and low false belief performances observed in the present study suggest that counterfactual reasoning does not pose as great a challenge to young children as do tasks of false belief. The findings suggest that it is not the counterfactual component which young children find difficult in tasks of false belief.

It is possible that methodological variations between the present study and that of Riggs et al. (1998) may account for the lack of replication. Riggs et al. (1998) made their comparisons of these types of task across a series of studies: Riggs et al. (1998) *Studies 1-3* paradigms were used to assess false belief and counterfactual reasoning (and not future hypothetical reasoning) and in *Study 4* future hypothetical reasoning and counterfactual reasoning (and not false belief) were assessed. This study attempted to measure more directly the associations between false belief, counterfactual and future hypothetical reasoning performance on all three concepts using a single paradigm. It is acknowledged that an inevitable consequence of the three-in-one scenario resulted in a slightly more complex set of procedures and testing scripts than used by Riggs et al. (1998). It is therefore possible that additional task-demands, resulting from the all-in-one paradigm used in this study may have been too complicated for the young children to understand fully.

Another procedural difference between the present study and Riggs et al.'s (1998) pertains to the counterfactual reasoning scenario. In the Riggs et al.'s (1998) study, an object is displaced in the protagonist's absence and the child is asked to report where the object would be had the experimenter not moved it. In the present study, the object was transformed as well as displaced. In the dirty shoes scene, for example, the shoes were cleaned and relocated to the "clean shoes box". This additional component to the testing script may have impacted the pattern of responding. By transforming the shoes from dirty to clean, the shoes then adopted a new categorical role, that of "clean shoes". It is possible that this transformation may have facilitated performance in this task by enabling the children to focus on the changes that had occurred more easily remembering the prior location. The transformation may have highlighted and cued salient changes and differences related to the relocation of the object.

Another potential methodological limitation of this study relates to the difference in script length between the *pretence-reality tracer* and *standard* test and control questions and the *pretence-no reality tracer* test and control questions. The *pretence-no reality tracer* scripts included an additional word in order to accommodate the reference to the "pretend" component of the shoes. That is, the testing script of the *pretence-no reality tracer group*, "Which box will Michelle look in first for her **pretend** shoes?" is slightly longer than those of the other two groups, "Which box will Michelle look in first for her shoes?" Ideally, testing scripts should not vary from each other in this way. Such a difference could therefore account for differences in performance observed between the groups. Future replication studies should attempt to control for this type of difference between scripts. One method to achieve this would be to include an extra word in both the *standard* and *pretence-reality group* scripts in order to balance the word length across all three groups. For

example, “Which box will Michelle look in first for her *nice shoes*”, with the additional word would make all testing scripts the same length.

The second aim of this study was to investigate preschool children’s ability to entertain counterfactual, false belief and future hypothetical situations while embedded in the context of pretence. The main finding emerging from the data shows that the *pretence-no reality tracer* group significantly outperformed the *standard* group on the false belief test question. This finding replicates that of prior investigations providing evidence to suggest that pretence may bolster young children’s performance on tasks of false belief (Cassidy, 1998; Hickling et al., 1997).

The final aim of this study was to assess the impact of reality tracers on the facilitative affects of pretence on young children’s false belief performance. The findings of this study revealed that the facilitative affect of the pretence on false belief performance observed in the *pretence-no reality tracer* group was *not* shown for the *pretence-reality tracer* condition. The *pretence-no reality tracer* group’s performance on the false belief task mirrored the low false belief performance of the children in the *standard* condition. This finding is in line with recent evidence showing that the facilitative pretence affects on false belief performance may be diluted in the presence of strong reality tracers (Cassidy, 1998).

Contrary to the experimental predictions, the context of pretence did not serve to enhance counterfactual reasoning performance in either of the pretence groups. The fact that pretence did not augment counterfactual performance as it did for false belief performance supports the notion that counterfactual reasoning abilities are not associated with false belief abilities. If the difficulty in handling counterfactuals was responsible for false belief failure, as proposed by Riggs et al. (1998), then a mechanism that successfully boosts performance of false belief, as a function of their shared counterfactual component, should also be expected to boost performance on

counterfactual reasoning tasks. This, however, was not shown to be the case. While pretence enhanced false belief performance in the *pretence-no reality tracer* group, counterfactual reasoning performance was unaffected.

5.3.i. Theoretical Implications

The main finding of this study showed that young children's false belief performance was successfully facilitated when embedded within the context of pretence. This effect, however, held only when no reality tracer was present. It was found that, when unexpected transfer false belief test questions were delivered under pretence conditions, performance was shown to be significantly higher than on the standard false belief task. This facilitative effect was not observed for false belief performance in the presence of a reality tracer.

5.3.i.a False Belief Facilitation and Reasoning Abilities

Riggs et al. (1998) proposed that young children's difficulty with false belief attributions in the early preschool years may be due to a more general difficulty in entertaining counterfactual situations rather than reasoning about beliefs *per se*. As argued above, the findings of the present study do not show evidence in support for this notion. It is argued herein that the counter-to-fact situation was not eliminated from the false belief *pretence-no reality tracer* scenario. That is, the children were still required to reason counterfactually about an out-dated pretence situation in order to pass the task (i.e. to recall the counter-to-fact state of affairs of the prior pretence as currently true by the protagonist). If it was the counterfactual component that was responsible for young children's failure, they would not be expected to show success on the false belief task, regardless of whether it was under the conditions of pretence.

5.3.i.b False Belief Facilitation and Representational Deficit Hypotheses

The false belief facilitation effect found in this study challenges the proposal that young children's difficulty with false belief tasks may due to a fundamental

deficit in representational understanding. Perner (1995), for example, argued that young children's lack of the fundamental understanding that beliefs may *misrepresent* makes them incapable of reasoning about mental states, such as false beliefs, that have a different truth value to that which they have assigned the situation. Similarly, Forguson and Gopnik (1988) have proposed that, prior to 4 years of age, children do not understand that mental representations are symbolic in nature, that is, that they do not necessarily need to reflect the true state of reality.

The facilitative affects of the pretend context on young children's false belief performance found in the present study do not support these representational deficit hypotheses. It is argued herein that, if false belief success requires conceptual understanding of the mental representation, the pretence condition could not reasonably have provided this. Success on this task has to be explained as something other than the child showing a representational understanding of false belief in this context. It is argued that the pretend false belief attribution process of the present study would *still* have required the child to set aside his or her own representation of reality and reason about the protagonist's representation of reality. The findings of this study suggest that it is not a representational understanding deficit that results in young children's false belief failure.

5.3.i.c False Belief Facilitation and the Simulation Theory

The findings of this study partially support a simulation account. The simulation view proposes that false belief tasks pose difficulty for the young child because they require complex perspective-shifting abilities. The success of children in the *pretence-no reality tracer* condition, by the simulation view, would be expected as the perspective shifting requirements would have been reduced by the context of pretence. Under conditions of pretence, the child is freed from his or her current perception of reality and can represent the target agent's perspective without

interference from reality. The developmental increases in performance on tasks of false belief throughout the preschool years, by this account, are due to maturation of perspective shifting and practical reasoning abilities (Harris, 1996). The fact that the facilitative effect of the pretend context clearly fell out in the presence of a reality tracer for the *pretence-reality tracer* condition would be explained by the simulation perspective as a consequence of increased processing requirements necessary to adjust the default settings to override perceptual reality in the presence of the reality tracer. The increasing ability to generate sophisticated pretend inputs enables adjustment of default settings to current reality. Standard tasks of false belief, from this view, underestimate young children's mentalising capabilities as the heavy task demands of complex perspective shifting impedes young children's ability to make correct attributions (Harris, 1996). In standard tasks, the child's own internal states provide no clue to the correct input selection to be entered into the decision-making mechanism; instead, knowledge of the current situation must be set aside in order to generate the correct inputs. Pretend episodes are said to operate under the same off-line processing mechanisms used in belief attribution; however, the processing load for default settings is lifted (Harris, 1994). Pretence, by this account, cues the child into a pretend world where normal empirical knowledge does not apply, and the representation is released from its referent so the child can effectively reason about the world without interference from current perceptual reality.

5.3.i.d False Belief Facilitation and Information-Processing

It is argued herein that the pretence-facilitation findings of this study may be accounted for by information-processing views of mentalising. These non-representational accounts maintain that executive functioning limitations are the cause of young children's failure on false belief tasks in the early preschool years. By these information-processing accounts, children respond to false belief attributions as if

they are questioned about the reality of the current situation with an apparent disregard of the protagonist's knowledge or perspective of the situation. Mitchell's (1994, 1996) reality masking hypothesis, for example, posits that preschool false belief failure is due to a fundamental inability to set aside a current representation of reality while simultaneously entreating an alternative representation of reality. Young children, according to this view, have a predisposition to be drawn to the reality of the situation and false belief tasks may therefore reveal little about children's mentalising capacities, as the tasks-demands may mask their mental state attribution capabilities. The differential pretence false belief attribution facilitation effect found in this study is consistent with this notion. That is, it was *only* in the condition with no reality tracer present that false belief performance was facilitated under conditions of pretence. In the presence of a reality tracer, children's pretence false belief performance fell to levels as low as that of standard false belief tasks.

The pretence-facilitation effect of this study is also in line with Russell et al.'s (1991) executive inhibition limitation hypothesis of false belief failure. As with Mitchell's (1994) reality masking hypothesis, by this view, young children have an inherent propensity to be drawn to the current state of reality. By this account, false belief success under conditions of pretence would be expected with the removal of the reality tracer, as children would not be required to disinhibit from what they currently know to be true of the object. The reality tracer would be expected to draw in the child without any contemplation of mental states. The findings of the present study are also consistent with this view.

5.3.ii Conclusions

In conclusion the findings of this study show that the context of pretence may bolster young children's false belief performance by reducing the processing-load required to disengage successfully from current reality to reason according to an

alternative representation of reality. The findings showed that in the presence of a reality tracer the facilitate effects of the pretend context on young children's false belief performance fell out. This finding provides strong evidence to support the notion that false belief failure in the early preschool years is a consequence of information-processing limitations, rather than a lack of representational understanding.

The present study was the first to assess directly the potential associations between young children's performance on tasks of future hypothetical, counterfactual and false belief reasoning within a single testing paradigm. The findings revealed that, contrary to the empirical predictions and the findings of prior research, no associations in performance were found between these standard tasks. Moreover, no significant differences in performance were observed between any of the standard tasks. It is concluded that counterfactual, false belief and future hypothetical reasoning processes operate under unique mechanisms that are not conceptually related. Thus, false belief failure, is *not* a consequence of the inability to handle counterfactual situations.

It is acknowledged that the complex three-in-one testing paradigm may have overwhelmed the children during testing. In chapter 6, the relationship between pretence and false belief will be further explored in a paradigm designed to ease extraneous processing demands required for the assessment future hypothetical and counterfactual reasoning in the present study.

CHAPTER SIX

Experiment Five

False Belief Performance in the Context of Pretence

6.0 Introduction

The main finding of Experiment 4 was that young children's false belief performance might be boosted in the context of pretence. The children in the *pretence-no reality tracer* condition were presented with a modified unexpected transfer Maxi false belief scenario whereby the object of transfer and location change were based on a shared episode of pretence between the child and the experimenter. The test question pertained to the protagonist's outdated pretence about the location of the pretend object. The results revealed that the children in the *pretence-no reality tracer* condition significantly outperformed a control group of children tested on the standard unexpected transfer Maxi false belief procedure.

It was concluded that this finding provided evidence against a theory theory representational deficit explanation of false belief failure in the early preschool years (Forguson & Gopnik, 1988; Gopnik & Slaughter, 1991; Perner, 1991). According to the representational deficit view, children's difficulty with false belief attribution lies with the failure to understand the symbolic nature of beliefs, namely that beliefs may misrepresent reality (Perner, 1995). False belief failure, by this account reflects an inability to distinguish the state of the world from a belief as a symbol of the state of the world (Perner, 1995). Despite the similar cognitive skills deemed necessary for understanding pretence (i.e. simultaneous suppression of a known to be true reality and representation of a counter-to-fact situation), supporters of the theory theory representational deficit hypothesis argue that pretence understanding does not reflect a true representational understanding of mental phenomena (Flavell, 1988; Forguen &

Gopnik, 1988). The dissociation in the age of onset of false belief understanding and pretence understanding is explained in terms of differences in the representational relation between pretences and beliefs (Gopnik & Slaughter, 1991). That is, pretences, by nature are never meant to stand for reality; whereas beliefs may or may not represent the true state of affairs, and therefore can cause interpretative difficulties for the young child. It is argued herein that, if the representational deficit hypothesis is correct, children ought to fail tasks of false belief irrespective of the pretend context because of an inherent inability to understand the representational nature of beliefs. The pretend context, would not be expected to lift the representational demands required for successful false belief attribution, for beliefs embedded within a pretend context still hold the representational component¹⁶. It was argued in chapter 5 that the pretence-facilitation finding therefore, was not consistent with the representational deficit view.

The successful negotiation of the false belief test question by the *pretence- no reality tracer* group in Experiment 4 is more consistent with non-representational accounts of false belief failure. Harris' (1996) simulation account of mentalising, for example, posits that the developmental trends in false belief performance throughout the preschool years are due to increasing abilities to exploit pretence capabilities. By this account, pretence skills are prerequisite abilities for the simulation process, as the shifting of frames required for alternative perspective taking of the mental state

¹⁶Note that some theorists have proposed that pretence is a process of non-representational, "acting-as-if" (the pretend episodes were true) process (Harris & Kavanaugh, 1993; Lillard, 1993b; Perner, 1991). By this view, children ignore the representational component of pretence by merely "acting-as-if" the proposition was true, while simultaneously recognising that it is in fact false. By this view, the false belief facilitation effect found in Experiment 4 would be explained in terms of the process of "acting-as-if" the pretend object had been displaced while holding on to the reality that it had not.

simulation is proposed to be grounded in the ability to exploit processes of imagery and pretence (Harris, 1991). Through the exploitation of pretence, it is proposed that the child is freed from his or her own current stance on reality, enabling him or her to successfully simulate a target agent's perception of reality (Harris, 1994). By this view the task demands in standard false belief tasks require sophisticated perspective shifting, and as a result, block the simulation process. The simulation account would predict that, if these task demands were lowered, performance should be enhanced. The pretence-facilitation effect observed in Experiment 4 is in line with this prediction. From the simulation perspective, encouraging children to use fantasy or pretence would serve to as a cue into a world whereby it is implicitly understood that real world knowledge does not apply. Pretend episodes, by this account, would be expected to bolster performance without interfere from the real world (Harris, 1994).

It was argued that the pretence-facilitation effect observed in Experiment 4 was also consistent with information-processing deficit explanations of false belief development. Such views posit that young children have a fundamental difficulty disengaging from reality, because of either a predisposition to be drawn to reality or to problems in inhibiting a prepotent response directed toward knowledge of reality (Mitchell, 1994; Russell et al., 1991). Information-processing accounts of mentalising development argue that the processing demands of standard tasks of false belief understanding result in task-specific responses and reveal little about young children's mentalising abilities. Following this line of reasoning, the context of pretence, by reducing the reality conflict, would be expected to lift the processing demands of standard false belief tasks. A false belief test question embedded within a pretend context need not require disengagement from what is known to be true about the current location of the object. Rather, within the context of pretence, the "reality" is replaced by pretend circumstances, so the child is not overburdened by the processing

required to overcome his or her knowledge of the true situation. The fact that the facilitative effects of the pretend context observed for the *pretence-no reality tracer* group in Experiment 4 did not hold for a second pretence condition including a reality tracer, (the *pretence-reality tracer* group), showed strong support for an information-processing account of false belief failure. The findings are consistent with Mitchell's (1994, 1996) reality masking hypothesis and Russell et al.'s (1991) inhibition of executive control hypothesis. By these accounts, children when confronted with conflicting reality representations, such as in false belief scenarios (i.e. outdated belief of protagonist versus true state of the world), they will default to reasoning about reality. These views propose that young children's performance would be enhanced on mentalising tasks in which the salience of reality is reduced, thereby reducing the likelihood generating a prepotent response directed toward reality. The finding of Experiment 4 supported this hypothesis. With the presence of a reality tracer eliminated from the *pretence-reality tracer* condition, false belief performance was boosted. Despite the pretend context in this condition, however, in the presence of a reality tracer, the performance of the children in the *pretence-reality tracer* condition was brought down to that of standard tasks of false belief. This dissociation in performance between the *pretence-no reality tracer* group (no reality tracer present) and the *pretence-reality tracer* group (reality tracer present) suggests that it is not the pretence *per se* that facilitated false belief performance, but the reduction in the salience of current reality which impacted on performance.

Experiment 4 was a multidimensional study, designed to test several elements of mentalising within a single paradigm, including the relationship between future hypothetical, counterfactual, and false belief reasoning, and the impact of a pretend context on these abilities. Although the false belief scenarios were designed to model the procedures of the standard Maxi unexpected transfer false belief task, the

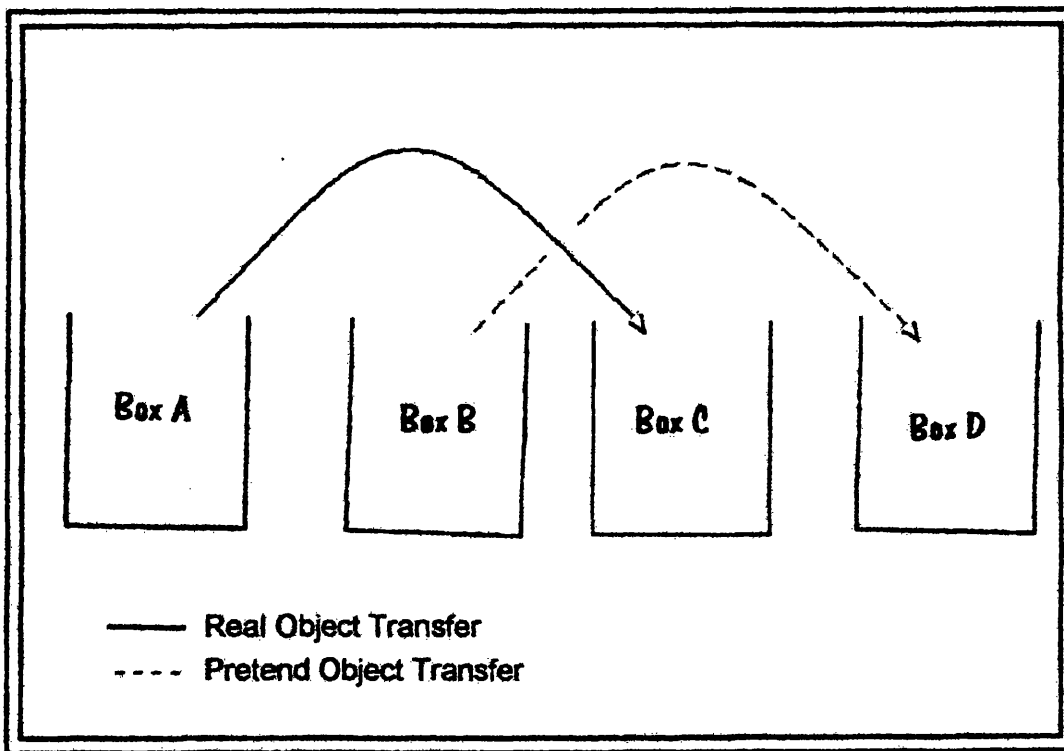
scenarios deviated from the standard paradigm in several respects. Rather than a straight object transfer, for example, the false belief test scenarios of Experiment 4 incorporated additional components to assess counterfactual and future hypothetical reasoning alongside false belief abilities. Procedural elements added to the false belief paradigms included categorical sorting trials (i.e. clean shoes into the “clean shoes box” and dirty shoes into the “dirty shoes box”) and physical state changes (i.e. cleaning of the shoes). It is acknowledged that a methodological consequence of creating a “three-in-one” empirical paradigm by incorporating a false belief, future hypothetical and counterfactual reasoning component in a single testing scenario may have resulted in additional task demands. Moreover, the children in the two pretence conditions had the additional “pretending” element, which added to the processing and attentional demands required for the scenarios. The aim of the present study was to attempt to replicate and further explore the pretence-facilitation effect finding of Experiment 4 through the use of a less complicated empirical paradigm and testing scenarios.

6.0.i Aim

The primary aim of Experiment 5 was to replicate the false belief pretence-facilitation effect observed in Experiment 4. In this study for the unexpected transfer Maxi false belief scenarios, all children were introduced to two objects of transfer (one real, one pretend) and witnessed *two* location changes: one following the standard location change procedures, the other embedded within a pretend context. All children observed both the real and pretend location changes; however, in attempt to reduce the likelihood of overburdening the children with heavy testing demands, each child was asked only one test question. All children were introduced to the same scenario, whereby in a protagonist’s absence, a “real” feather was transferred from *Location A* to *Location C*, and a “pretend” feather was transferred from *Location B* to

Location D (See Figure 6.1 for diagram). The children in the *pretence* condition were asked to respond about the protagonist's outdated "pretence" about the location of the pretend object, and the children in the *standard* condition were asked about the protagonist's outdated "belief" about the location real object. It was hypothesised, in line with the findings of Experiment 4, that the children asked to solve the false belief task under conditions of pretence would significantly outperform the children asked to solve the standard false belief task.

Figure 6.1: Diagram depicting the location changes for the "real" and "pretend" objects of the testing scenario.



6.1 Method

6.1.i Design

A between-subjects design was used in this study. Group assignment, *standard* or *pretence*, was the independent variable. The dependent variable was the children's performance on a false belief-type test question (either standard or pretence as per group assignment). All children in the study were presented with two

consecutive unexpected transfer Maxi location change scenarios (Wimmer & Perner, 1983). One location change modelled the procedures of the standard task. For the second location change scenario, the children were asked in the protagonist's absence to *pretend* the relocation of a pretend object. The children in the *standard* group were asked to indicate where the protagonist, upon his return, thought the real object was located. The children in the *pretence* group were asked to indicate where the protagonist upon his return was pretending the pretend object to be. All children witnessed both types of transfers (standard and pretend) presented in a counterbalanced order; however, the two groups differed according to which test question they were administered (standard or pretend).

6.1.ii Participants

The participants were 40 children recruited from two preschools in London. All children were native speakers of English. The children were of mixed ethnicity, with approximately 55 percent Caucasian and 45 percent from ethnic minority groups. There were 20 children (9 boys, 11 girls) in the *standard* condition and 20 children (10 boys, 10 girls) in the *pretence* group. The mean age of children assigned to the *standard* group was 3:10 (years: months) (standard deviation of 4.5 months), ranging from 3:3 to 4:6 (years: months). The mean age of children assigned to the *pretence* group was 3:10 (standard deviation of 5.4 months), ranging from 3:2 to 4:6. Group assignment was age-matched. An independent samples t-test confirmed that there were no significant differences in the age between the children assigned to the two conditions, ($p > 0.1$, two-tailed).

6.1.iii Materials

One small boy doll, 6 centimetres in height was used as the story protagonist and one feather, 4 centimetres in length, was used as the object of transfer. Four

small differently coloured and shaped boxes, each measuring approximately 6 X 3 X 3 centimetres were also utilised.

6.1.iv Procedure

The children were invited to play a game with the experimenter. All children were tested individually in a quiet room of the preschool. The children sat opposite and facing the experimenter at a table. The four coloured boxes were placed in a horizontal row between the children and the experimenter. The alignment order of the boxes was randomised for each participant. Each child was then introduced to the protagonist and the testing materials (See *Table 6.1* for script). It was explained and demonstrated to the child how the protagonist enjoyed placing both “real” and “pretend” feathers into the four differently coloured boxes. Following this introduction, the children were asked control questions pertaining to the starting locations of the real and pretend feathers (See *Table 6.1*).

The order of introduction of the real and pretend feathers was counterbalanced across children. One half of the children were introduced to the real feather first followed by the pretend feather. The order of presentation was reversed for the remaining half of the children. The starting locations of the real and pretend feathers were counterbalanced so that for one half of the sample the real feather was initially placed in *Location A* (to be transferred to *Location C*) and the pretend feather was placed in *Location B* (to be transferred to *Location D*) (See *Figure 6.1*). The starting locations of the feathers were reversed for the other half of the sample so that the real feather was transferred from *Location B* to *Location D* and the pretend feather was transferred from *Location A* to *Location C*.

Table 6.1: Location change script with pretence and standard test questions.

(Child is introduced to doll) <i>"This is Richard and he has a feather in this red box."</i> (Experimenter tips the red box so that feather in the box is in the child's view) <i>"Richard loves to play games with his feather. He likes to move the feather into different boxes. Richard also likes to <u>pretend</u> that he has another feather here in this blue box"</i> (Experimenter tips the blue box so the child can see that the box is empty. The experimenter reminds the child that the feather this box contains a pretend feather and, therefore, it cannot be seen). <i>"Richard loves to play games with his pretend feather. He likes to move the pretend feather into different boxes."</i> Location Control Questions: <i>"Where is the real feather?"</i> <i>"Where is the pretend feather?"</i> (If an incorrect response is given, the child is reintroduced to the materials and the procedure is repeated until the correct response is given) <i>"Richard is going to go sleep in my bag."</i> (Exit Richard doll) <i>"While Richard is asleep in my bag, let's play some more without him. Let's move the <u>real</u> feather out of this red box and let's put it into this green box"</i> (Experimenter moves feather to green box) <i>"Was Richard playing with us?"</i> (Experimenter appropriately reinforces response) <i>"Now let's pretend to move the <u>pretend</u> feather out of this blue box and let's pretend to put it into this yellow box."</i> (Experimenter pretends to move the feather to the yellow box) <i>"Was Richard pretending with us?"</i> (Experimenter appropriately reinforces response. Richard is made to return) Test Questions: Standard Group: <i>"Which box is Richard thinking his <u>real</u> feather is in?"</i> Correct Response: red box Pretence Group: <i>"Which box is Richard pretending his <u>pretend</u> feather is in?"</i> Correct Response: blue box
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All children were correctly able to indicate the starting location of the real feather. Five children in the *pretence* group and three children in the *standard* group, however, incorrectly indicated that the pretend feather was meant to be in the same box as the real feather. In these instances the children were reintroduced to the materials and the scenario. It was highlighted that the pretend feather was not real and, therefore, could not be seen by the child. The procedure was repeated and the children were asked the location control questions again. All of the children initially failing the pretence control question demonstrated success on the second attempt. Following the administration of the control questions, the protagonist was made to exit the scene. The experimenter then suggested that she and the child play some “feather games” in the protagonist’s absence. The real and pretend feathers were then relocated to two new locations (See *Figure 6.1* and *Table 6.1*). The order of presentation of the transfer of real and pretend objects was counterbalanced across children so that for one half of the sample the real object was transferred first and for the other half of the sample the pretend object was transferred first. Control questions followed pertaining to the new locations of the objects. In the case of incorrect responding to these control questions, the children were reintroduced to the sequence of events. All children responded correctly on the second set of control questions.

Following the two location changes, the protagonist was made to return and the test question was administered. The children in the *standard* condition were asked to report in which of the four boxes the protagonist was “thinking” that his feather was located (Correct response: initial real feather location, *Box A* as shown in *Figure 6.1*) and children in the *pretence* group were asked to indicate which box of the four boxes the protagonist was “pretending” his pretend feather to be in (Correct response: initial pretend feather location, *Box B* as shown in *Figure 6.1*).

6.2 Results

The children were scored on a pass/fail criterion for the standard belief and pretence test questions¹⁷. The children in the *standard* group were scored as passing if the initial location of the real object was selected (*Box A* as displayed in *Figure 6.1*). The *standard* group children were scored as failing the task if any other box was selected (See *Figure 6.1*, Boxes *B*, *C* or *D*). Children in the *pretence* condition were scored as passing the task if the box in which the pretend object was initially located was selected (*Box B* as displayed in *Figure 6.1*). The *pretence* group children were scored as failing the test question if any other box was selected (See *Figure 6.1*, Boxes *A*, *C* or *D*).

6.2.i Between-group Performance

Only 2/20 (10 percent), of the children in the *standard* group and 6/20 (30 percent), in the *pretence* group passed the test question. A chi-square analysis showed that the proportion of children passing this task did not differ between groups,

$$(\chi^2(1, N = 40) = 2.59, ns).$$

6.2.ii Error Analysis

In light of the unexpectedly low performance of the sample on the test question (80 percent failing), a *post hoc* analysis of the children's errors was undertaken in an attempt to identify potential systematic trends. Unlike the standard forced-choice, two-location object transfer false belief task, the present design with the additional pretend object transfer created a total of four possible response

¹⁷All children in the two conditions successfully passed control questions pertaining to the real and pretend object starting states before the administration of the real and pretend object transfers and test question.

locations: two for the *real* object transfer and two for the *pretend* object transfer (See Figure 6.1). As no significant between-group differences in types of error were observed for the *pretence* and *standard* groups, a multinomial analysis of the entire sample was considered justified. A multinomial comparison showed that the sample was not responding randomly (box selection was not at chance level), ($\chi^2(3, N = 40) = 9.0, p < .05$). In other words, the distribution of responses across boxes was not due to chance.

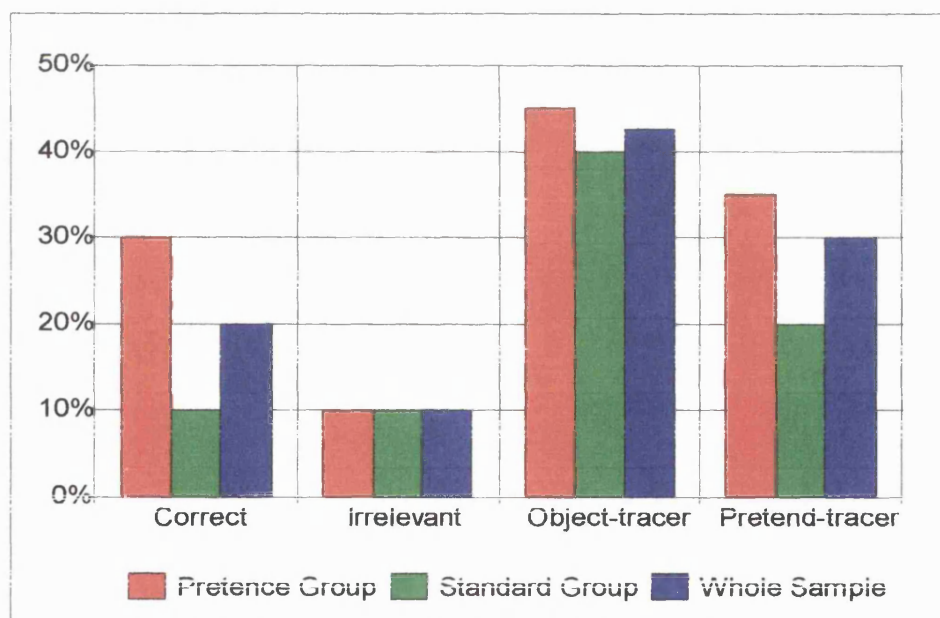
A *post hoc* error analysis coding scheme was devised according to the children's type of incorrect responses. Three types of errors were identified for both the *pretence* and *standard* groups. The incorrect selection of the box in which the real object was located at the time of responding was dubbed an *object-tracer error* (Figure 6.1 Box C). Likewise, the incorrect selection of the box in which the pretend object was meant to be in at the time of responding was coded as a *pretend-tracer error* (Figure 6.1 Box D). *Irrelevant errors* were those in which the child selected the box that was the starting location of the object that they were *not* tested on. In the *standard* group, for example, when asked about the protagonist's belief about the location of the *real* object, a response would be coded as an *irrelevant error* if the starting box of the *pretend* feather was selected (Box B as shown in Figure 6.1). Similarly, in the *pretence* condition, an incorrect response was coded as *irrelevant* if the box that the *real* feather was initially located was selected in response to the test question (Box A as displayed in Figure 6.1).

6.2.ii Between-Group Error Analysis

Figure 6.2 shows the percentage *irrelevant*, *object-tracer*, *pretend-tracer* and *correct* responses of children in the *pretence* and *standard* conditions. As can be seen in Figure 6.2, few children made *irrelevant* response errors with just 2/20 (10 percent) from the both the *standard* and *pretence* groups making this type of error. The

object-tracer was made by 9/20 (45 percent) from the *pretence* group and 8/20 (40 percent) from the *standard* group made this type of error (See Figure 6.2). In the *pretence* group 7/20 (35 percent) children made a *pretend-tracer* response in comparison to 4/20 (20 percent) children from the *standard* group. A series of chi-square analyses showed that there were no between-group differences in the proportion of errors made by the *pretence* and *standard* groups (*irrelevant*: $\chi^2(1, N = 40) = 0.0$, ns; *object-tracer*: $\chi^2(1, N = 40) = 1.02$, ns; *pretend-tracer*: $\chi^2(1, N = 40) = 1.13$, ns).

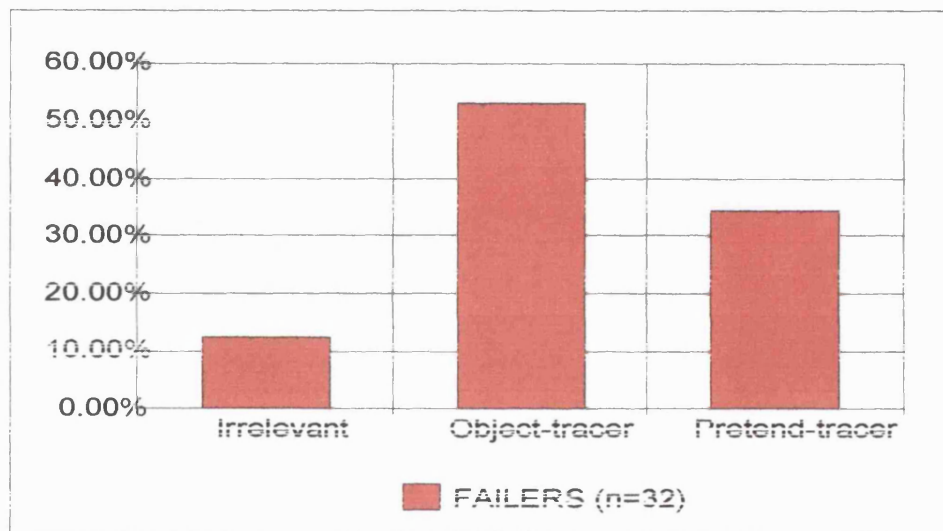
Figure 6.2: Percentages of children making correct, irrelevant, object-tracer and pretend-tracer responses.



As no significant between-group differences in types of error were observed for the *pretence* and *control* groups, a multinomial analysis of all 32 children in the sample was considered justified. Figure 6.3, shows the distribution of the type of errors from the 32 out of 40 children in the sample who failed the test question. The most frequent type of response was the *object-tracer error*, with 17 out of 32 (53.1 percent) children responding as such. The next most frequent error committed by the

sample was the *pretend-tracer error* with 11 out of 32 (34.4 percent) children selecting this response. Only 4/32 (12.5 percent) made *irrelevant error* box choice. A multinomial comparison of the error types by those children responding incorrectly to the test question showed that the type of error made was not random, ($\chi^2(2, N = 32) = 7.94, p < 0.02$).

Figure 6.3: Percentage irrelevant, object-tracer and pretend-tracer responses made by children failing the test question.



6.3 Discussion

The aim of the present study was to replicate the facilitative effect of pretence on young children's false belief performance found in Experiment 4. In Experiment 4, pretence was shown to have a facilitative affect on false belief performance but only in the absence of a reality tracer. The present study, with the inclusion of two possible starting location tracers (real and pretend), was also designed to explore further the impact of such tracers on young children's false belief performance. The procedure combined a standard location change and pretence based location change within a single scenario. The children in the *pretence* condition were asked to respond to a false belief test question pertaining to the protagonist's pretence about

the location of a pretend object. The children in the *standard* condition were asked to respond to a test question pertaining to the protagonist's belief about the location of a real object. Based on the pretence-facilitation effect observed in Experiment 4, it was hypothesised that the *pretence* group would outperform the *standard* group on the false belief test question. The findings of this study, however, did not support this prediction. No significant between-group differences in false belief performance were observed.

It was argued in chapter 5 that the pretence-facilitation effect observed in Experiment 4 supported non-representational explanations of false belief failure in the preschool years. For example, from the simulation perspective, pretence and imagery skills form prerequisite skills for the simulation process. The act of pretence, frees an individual from his or her knowledge of the true state of affairs permitting him or her to simulate the perceptual reality of another without interference from the real world (Harris, 1994). Harris maintained that standard false belief tasks, reveal little about young children's mentalising capabilities, for the task demands are such that sophisticated perspective shifting are required, serving to block the simulation processes. By this view, lifting such processing task demands by encouraging children to reason in a pretend context would be expected to facilitate mentalising performance. The pretence-facilitation effect observed in Experiment 4 supported this notion. In the present study, however, no such facilitative effects of pretence on false belief performance were observed. This finding challenges the simulationist view, for pretence did not serve to boost false belief performance. What the finding of the present study suggests is that it was not the pretence *per se* which bolstered performance in Experiment 4. That is, had pretence been the key to lifting the processing demands, it should have been replicated in the present study with the utilisation of a simpler and direct assessment testing procedure.

It was also argued in chapter 5 that the false belief pretence-facilitation effect seen in Experiment 4 was consistent with information-processing accounts of false belief understanding. Like the simulation theory, information-processing accounts propose that standard tasks of false belief understanding require heavy processing demands which limit young children's ability to arrive at correct mental state attributions. Mitchell (1994) and Russell et al. (1991) have argued that false belief failure in the early preschool years is due to the inability at the level of executive processing to override the salience of reality when forming attributions. Mitchell's (1994) reality masking hypothesis posits that children fail false belief attributions because they have an inherent predisposition to be drawn to the true state of affairs. Similarly, Russell et al. (1991) explained false belief failure as the inability to inhibit a prepotent response directed toward knowledge of reality. By these accounts, a reduction in the salience of reality, such as under conditions of pretence, would be expected to increase children's performance on false belief tasks. The pretence-facilitation effect in Experiment 4 supported this hypothesis.

It is argued that the failure to replicate the pretence-facilitation effect in the present chapter does not necessarily refute the Mitchell (1994) and Russell et al. (1991) reality bias explanations. Recall that in Experiment 4, the facilitative effects of pretence on false belief understanding were observed only in the pretence condition that had *no* reality tracer present, the *pretence-no reality tracer* group. When a reality-tracer was present in the pretence condition as in the *pretence-reality tracer* condition, children's false belief performance was as low as those in the *standard* condition. This finding supported the notion that pretence may facilitate false belief performance when the salience of current reality is reduced, in line with the predictions of reality bias hypotheses. In contrast to the findings of Experiment 4, the children in the *pretence* condition of the present study did not outperform the

standard group on the task of false belief. The children in the *pretence* condition, like the *pretence-no reality tracer* group of Experiment 4 did not have a reality tracer present to represent their “pretend” object or during the “pretend” object relocation. The *pretence* condition in the present study, although designed to model the *pretence-no reality tracer* condition of Experiment 4, may have more closely resembled Experiment 4’s *pretence-reality tracer* condition because of the lack of any reality tracer present for the pretence test question. In this study, a real object was present throughout the testing scene for the standard transfer; although the children were not directly questioned about this object; its presence may have interfered with their ability to entertain the pretence episode. It is therefore argued that the findings of the present study may not necessarily be in direct conflict with those of Experiment 4. It is argued that the failed pretence-facilitation effect of the present study may due to the presence of this reality tracer throughout the paradigm. These findings suggest that the children’s orientation toward reality was strong enough to penetrate even the pretend circumstances. In this study, as in the pretence condition, the object need not have been present to have high salience to the child.

Performance of both the *pretence* and *standard* groups on the test question was very low. Only 10 percent of the *standard* group and 30 percent of the *pretence* group passed the test question. One possible explanation for the low performance of the children in general could have been due to the procedural deviations from the standard unexpected transfer Maxi false belief task procedures. In the present study, with the addition of a pretence transfer, two extra locations and therefore two additional possible response choices were added to the paradigm. Thus, unlike standard forced-choice, two-location object transfer, the present study created a total of four possible response choices: two for the *real* object transfer and two for the *pretend* object transfer. This design may have introduced additional processing loads

on memory required to keep track of two objects and four boxes. The multinomial analysis showed that the low performance rate of the children on the false belief task could not have been due to random responding. It is possible that the lack of a difference between the type of tracer error made by the children in both groups was a result of the children misinterpreting the nature of the test question. The test question differed between the two groups only slightly in script and it is difficult to conclude with certainty whether the children were responding to the relevant test question. The pre-test control questions revealed that initially many children (20 percent) when questioned about the pretend object often responded as if they were being questioned about the real object¹⁸. It is therefore possible that this also happened for some children on the test question. The timing of control questions in this study may have been better placed just prior to the test question in order to determine whether the children understood the script and scenario up to that crucial point. Incorrect control question responses discovered prior to the test questions would have enabled the experimenter to review the script with the child in order to ensure that he or she understood the prerequisite components necessary for the test questions. With the control questions following the test questions, it is more difficult to conclude whether the children understood the nature of the scenario at the point of testing. Future replication studies should modify timing of the control question in this regard.

In light of the unexpectedly low performance of the children in both groups, a *post hoc* error analysis coding scheme was devised in order to explore potential trends in incorrect responding. An error analysis coding scheme was necessary to decipher what types of mistakes the children were making¹⁹. While no between-group

¹⁸Note that all were successful on second control question attempt.

¹⁹ An analysis of the frequency of box selection (A, B, C, or D) would have not provided meaningful analysis. The selection of Box A, for example, for the pretence group would indicate an incorrect response, whereas for the standard group, Box A was the correct response. For this reason, rather than analysing the specific box selected, a descriptive coding scheme was devised to identify the type of errors made by the children.

differences in errors were observed, a multinomial analysis of the children failing the test question showed that the type of error made was not random. Follow-up analysis showed that the children who failed the test question made significantly more *pretend-tracer* and *object-tracer* responses than *irrelevant* responses. The fact the children were not responding randomly suggests that the measures utilised in this study were valid false belief assessments. Only 10 percent of the children failing the test question made *irrelevant* responses. In contrast, 76.9 percent of the incorrect responses were *tracer errors*: 42.5 percent *object-tracer* and 34.4 percent *pretend-tracer*.

There were no significant between-group differences in the type of error made by the children in the two groups. The children in the *standard* condition were slightly more likely (although not significantly more so) to commit *object-tracer errors* and likewise the children in the *pretence* condition were slightly more likely to make *pretend-tracer errors*. The children in both conditions showed a tendency to be drawn to the “real” object when responding by making the *object-tracer error*. This finding is in line with Mitchell's (1994) and Russell et al.'s (1991) reality bias hypotheses, however, the fact the children in both the *pretence* and *standard* conditions also showed a tendency to be drawn to the location that the pretend object was meant to be in at the time of responding, committing the *pretend-tracer error*, is not consistent with a reality bias explanation. Unlike the *object-tracer error* (selection of the current location of the real object), the *pretend-tracer error* (selection of the current location of the pretend object) cannot be attributed to the inability to override current knowledge of reality because in there was no physically observable reality tracer present. While a reality bias explanation supports the instances *object-tracer errors*, it may not plausibly be applied to *pretend-tracer errors*. There was no alternative reality tracer to be drawn to in selecting the box in

which the pretend object was currently located as this object existed only in pretence. A *pretend-tracer error*, it is argued may not adequately be justified as a predisposition to override to current knowledge of reality.

There was no between-group dissociation in the type of tracer error committed. *Object-tracer errors* were made by 40 percent of the children in the *standard* group and by 45 percent of the children in the *pretence* group and *pretend-tracer errors* were committed by 20 percent of the *standard* group and 35 percent of the *pretence* group. Had there been specific trends showing that the children in the *standard* group were consistently drawn to make *object-tracer errors* and not *pretend-tracer errors*, and the reverse trend was observed for the *pretence* group, a reality bias explanation may have been used to explain the findings. However, such group-specific trends in responding were not observed. It is of interest to note that while there were no differences in frequency between *object-tracer* and *pretend-tracer errors*; such errors were significantly more likely to be made than *irrelevant errors*. This finding suggests that there was something appealing about the current locations (*pretend-tracer*, and *object-tracer*) which interfered with performance and was not a consequence of random responding.

When children in this study erred, they did so systematically by committing two of three possible incorrect responses, tracer responses. These types of responses share the common element of being the current location of the object of transfer. The fact that children persevered with selecting these two types of responses may suggest a more general non-mentalising executive function limitation. It is argued that the findings of this study support this type of explanation. The children, regardless of condition, were likely to be drawn to the two current locations of the objects of transfer. This may suggest that the children were incapable of updating their knowledge of the situation whilst bearing in mind their old knowledge of the location

of the objects. In this study, the children in being drawn to the “tracer” responses may have been overgeneralising their own knowledge of the “true” state of affairs and, in doing so, disregarded any representational function of mental states. This explanation is in-line with Fodor’s (1992) modular “Very Simple Theory of Mind” (VSTM) hypothesis. Computational simplicity of the VSTM dictates that when faced with complicated mental state attributions, a default strategy is adopted oriented toward nonrepresentational desire reasoning. The attribution will be solved according to non-representational desire component. That is, the child will consider what action will satisfy the protagonist’s desire to obtain the object, rather than the representational belief consideration of what action the protagonist would take to satisfy his or her desires if his or her belief was true. When information-processing demands are high, this desire default strategy is adopted, resulting in incorrect belief attributions.

6.3.iii Conclusion

In conclusion the findings of this study show that context of pretence itself, may not be enough to bolster young children’s false belief understanding. It is argued that while in some contexts pretence may lift the reality load required for processing, this effect does not hold to situations in which a reality tracer is present. This suggests that it is not the element of pretence which provides the facilitative effect on false belief understanding. Rather some conditions of the pretend context may serve to reduce a more general processing load of standard tasks of false belief understanding. Specifically, young children may be incapable, at the executive functioning level of processing, of adequately reasoning about the location change procedure. This inability to understand the impact of the location change may render them incapable of arriving at the correct attribution. Future studies should explore more fully how such processing demands of standard tasks are associated to executive processing in attempt to identify at what stage of processing children err. Such

investigations would provide further insight into identifying whether young children's early difficulties with false belief understanding are grounded in a representational understanding deficit or reflect a broader difficulty in executive processing.

CHAPTER SEVEN

Summary and General Discussion

7.0 Summary of Chapters One to Six

The objective of this thesis has been to test contemporary accounts of the development of mentalising capabilities during the early preschool years. Specifically, the experiments were designed to test the main hypotheses put forward by the three dominant theories of mentalising development: the theory theory, the simulation theory, and the information-processing theory.

Through a series of investigations, both traditional and novel testing paradigms were utilised to assess young children's mentalising performance. Standard mentalising assessment paradigms were modified in order to assess theoretical predictions more definitively than in previous investigations. The usual reliance on standard false belief assessments to explain mentalising development has limited prior discussions to holistic *post hoc* theoretical interpretations of what false belief failure may imply. It is argued that the continued emphasis on explaining false belief failure, rather than generating theoretically driven predictions about false belief performance, is a limitation of research to date. The mentalising literature has lacked a clear methodological approach: novel empirical techniques generated by mutually exclusive *a priori* theoretical predictions are needed to assess differential theories of mentalising. Past explanations of the mechanisms of mentalising development have relied upon observations of false belief failure; in the present work, specific theoretical predictions have guided the manipulation of standard mentalising assessments so that, by enhancing children's performance on the tasks, clearer insight into the mechanisms which enable adultlike mentalising capabilities is gained.

7.0.i Chapter One: Literature Review

In chapter 1, the three dominant theories of mentalising were reviewed: the theory theory, the simulation and the information-processing theories. Each of these theories relies on traditional false belief assessments to explain the developmental increases in the ability to attribute mental states to others throughout the preschool years. Success on such tasks has come to be regarded as the hallmark of full-blown mentalising, since it appears to denote a sophisticated understanding of how beliefs influence behaviour. Although the age at which false belief task success emerges has been clearly established, there is considerable theoretical debate over what cognitive-developmental processes enable false belief understanding.

The theory theory posits that mentalising is underpinned by a functional folk-psychological theory, an implicitly held body of common-sense knowledge informing the domain of mentalising. Among proponents of the theory theory, diverse accounts of the mechanism by which the theoretical knowledge system operates have been proposed. The rationalist view maintains that mentalising abilities operate via innate, domain-specific mechanisms of the mind called "modules" (Fodor, 1987). This modular account of development proposes that folk-psychological concepts are acquired through the maturation of specific modules which govern a system of representations and representational input. False belief failure in the early preschool years by the rationalist account of the theory theory is explained as a task-specific artefact rather than a reflection of mentalising competence *per se*. In contrast, the theory theory "child-as-scientist" hypothesis proposes that the development of a genuine understanding of the mind proceeds through a stagelike progression of modification of folk-psychological principles (Gopnik & Meltzoff, 1997). In this account, as children develop a theory of mentalising, they construct "layperson theories" about the world which, in turn, regulate their perception and understanding of the world around them. Contrary to the rationalist or modular account of

development, the child-as-scientist view proposes an active process of folk-psychological acquisition whereby a basic defeasible theoretical mechanism is continuously modified until a formal adultlike theory of folk-psychology is acquired. False belief failure, in this view, is explained in terms of a general deficit in the ability to recognise and understand the representational nature of beliefs. Criticised for the theory's lack of parsimony and for the inability of theory theorists to articulate a complete syntax of the mechanism by which the proposed theoretical system is meant to operate, the theory theory has traditionally been confined to philosophical discussion rather than empirical assessment.

According to the simulation theory of mentalising, mental attributions are generated through the exploitation of an individual's own mental resources coupled with the capacity for off-line practical reasoning (Gordon, 1986; Heal, 1986). In the process of simulation, an attempt is made to identify imaginatively with the perceptual reality of another. Once the shifting of perspective is complete, the simulator agent exploits his or her own decision-making mechanisms to generate an off-line solution. In ascribing mental states to another, individuals pretend to be in the other's place, decide what to do or feel, and then attribute the decision to the other individual. The simulation theory posits that, through increasing power of imaginative identification, children begin to acknowledge that individuals may differ in mental stance and thus may interpret objects differently. In this account, false belief failure in the early preschool years is explained in terms of the complexity of the simulation required for task success, rather than as an inherent deficit in attributing mental states to others.

In information-processing accounts of mentalising development, it is proposed that the increase in mentalising capacity throughout the preschool years reflects the development of certain processes of practical reasoning and executive function. A

predominant focus of information-processing accounts of mentalising is to explain the types of errors exhibited by young children when making mental state attributions (Frye et al., 1995; Hughes; 1998; Leslie & Polizzi, 1998; Mitchell, 1996; Riggs et al., 1998; Russell et al., 1991). These views posit that false belief failure is caused by specific cognitive errors attributable to the immaturity of the brain, namely the failure to inhibit a default strategy of current reality (Mitchell, 1996), the failure to inhibit a prepotent response directed toward reality (Russell et al., 1991) or a more general deficit in entertaining counterfactuals (Riggs et al., 1998) or reasoning conditionally (Frye et al., 1995).

7.0.ii Chapters Two and Three: Experiments One and Two

Experiments 1 and 2 were designed to investigate the predictions of the theory theory child-as-scientist view of mentalising via the implementation of false belief training schemes. The child-as-scientist view posits that exposure to mentalising principles during training would be expected to provide sufficient “data” to trigger a theory reformation, therefore improving false belief performance. Experiment 1 aimed to replicate the successful false belief training effects found in the literature while addressing the key methodological issues of baseline performance, target concept, generalisation assessment, and training procedures. A training regime was devised based on a combination of methods previously used in training studies. In conflict with the findings of prior false belief training studies, the results of Experiment 2 showed that mentalising training did not lead to significant generalisation of conceptual knowledge to nontrained tasks.

In light of the failure to replicate the positive false belief training generalisation effects found in the literature, Experiment 2 was designed to further address methodological issues pertaining to the use of training schemes. A false belief training regime similar to that of Experiment 1 was utilised. In addition, this

study attempted to assess the child-as-scientist “conceptual coherence” hypothesis. According to this hypothesis, mentalising understanding is consolidated throughout development within a set of domain-specific concepts, such that when new knowledge pertaining to a concept within the domain is acquired, it influences the understanding of other concepts within that domain (Slaughter & Gopnik, 1996). Conceptual coherence was assessed in this study by an additional non-false belief mentalising-training group, a Level-2 visual perspective taking training group. In addition, further generalisation assessments of non-false belief pre- and post-mentalising tasks were included. The main findings of Experiment 2 successfully replicated those of Experiment 1. Training children in false belief understanding resulted only in training-task-specific improvements in mentalising performance. The Level-2 visual perspective taking training showed similar results, with the training group demonstrating significant improvement in pre- to post-test performance on only the Level-2 task in which they were trained. Like the false belief training group, the trained Level-2 group did not show generalisation of trained concepts to a distant transfer Level-2 task or to a second training-related task.

The consistent finding across Experiments 1 and 2 that training produced only improvements in training-related tasks at the time of post-testing strongly suggests that the child learned task-specific strategies for success rather than any form of conceptual knowledge. These findings suggest that, in the current studies, the experience provided by the training schemes was not sufficient to induce the hypothesised theory reformation as proposed by the child-as-scientist view.

The lack of training effects of Experiments 1 and 2 demonstrate that young children cannot be taught a conceptual understanding of mentalising concepts via group-discussion sessions highlighting the events of false belief testing scenarios. These findings do not, of course, mean that such abilities may not be successfully

trained by alternative means; this is an issue for future research to determine. It is entirely possible that young children's mentalising performance may be boosted through the implementation of mentalising training schemes. Nevertheless, the present findings do suggest that such capabilities are not as readily trainable as some prior researchers have claimed (Appleton & Reddy, 1996; Slaughter, 1998; Slaughter & Gopnik, 1996)

7.0.iii Chapter Four: Experiment Three

In Experiment 3, a novel attribution paradigm was designed to address the base assumptions and predictions of the theory theory and the simulation theory. In this study, conditions were designed to provide optimal circumstances for the use of theoretical knowledge and for simulation processing. The optimal theory theory condition was based on the rationale that mental state attributions are grounded in an implicitly held body of knowledge and interconnected rules pertaining to the domain of “why people do things”. By this view, predicting a target agent's belief based on his or her current action may be easier for the young child than an action-to-belief prediction. The optimal condition for simulation was based on the notion that the simulator agent relies on solving mental attributions at the level of action in the form of “What will I (as simulated other) do now?” Based on this line of reasoning, predicting an individual's action as based on his or her currently held belief would be easier than the converse. The belief-to-action attribution would require simulating the other's perspective and solving the problem in terms of the child's own decision-making processes. The action-to-belief attribution would be considered more difficult, as the simulation process dictates that the child must make some default adjustments in order to abstract inferences which relate action and behaviour to mental states.

The impact of thought bubble cueing on children's mentalising performance was a second method by which the differential predictions of the theory theory and the simulation theory were evaluated in Experiment 3. According to the simulation perspective, the use of pretence and imagery are prerequisite skills for the simulation process (Harris, 1992). Moreover, the ability to adequately shift frames and assume the perceptual reality of another is viewed as depending on the ability to pretend or imagine the simulated perspective of the target agent. Following this rationale, thought-bubble cues as images of the target agent's currently held thoughts may bolster the effectiveness of the simulation process. From the theory theory perspective, however, pretence and imagery skills are not considered necessary for mentalising. A thought-bubble cue would not, according to the theory theory, be expected to facilitate the theoretical knowledge base pertaining to mentalising.

This study revealed that, contrary to the hypothesised differential expectations of the theory theory and the simulation theory, action-to-belief predictions were not significantly different from belief-to-action predictions. It was found, however, that thought-bubble cueing had a differential impact on the children's mentalising performance. Children in both the simulation and theory theory cued groups performed significantly better than those in the simulation and theory theory non-cued groups on tasks of true belief. No main effect for cueing was found for false belief tasks, although a significant cueing by direction-prediction interaction was found. Only for belief-to-action predictions did a facilitative cueing effect emerge for tasks of false belief. This facilitative effect on belief performance suggests that imagery may play a more crucial role in mentalising than is acknowledged by the theory theory. Indeed, this finding could be viewed as supporting the simulation view: that pretence and imagery are prerequisite skills for the process of mentalising. The thought bubbles, as pictorial representations of the protagonist's current false belief,

may have provided the crucial starting state for the simulation, enabling the children to merely plug this information into their own decision-making mechanisms and arrive at a solution attributable to the protagonist. According to the simulation account, when children err on tasks of belief attribution, they do so at the level of input into the decision-making system; that is, they fail to input a non-egocentric view of the world truly representative of the protagonist's view of the world. If inaccurate inputs are fed into the system, a successful attribution will not obtain. If, however, inputs closely matching those of the protagonist are entered, the simulation process is likely to produce a plan of action that is representative of the protagonist's likely action. The findings of Experiment 3 suggest that, when the protagonist's initial mental states are provided in pictorial format, the burden of simulating his or her perceptual reality is reduced.

7.0.iv Chapters Five and Six: Experiments Four and Five

In light of the observed facilitatory effect of thought bubbles on young children's false belief performance, Experiments 4 and 5 attempted to explore the impact of imagery and pretence on young children's mentalising abilities. In chapter 5, the literature relating to pretence and mentalising was reviewed, addressing issues pertaining to the paradoxical age dissociation in the onset of these abilities. Despite the apparently similar cognitive skills deemed necessary for pretence and mentalising (i.e. the suppression of current knowledge and reasoning according to an alternative reality), it is well documented that acts of pretence emerge about two years before false belief understanding. Theory theorists generally explain the age dissociation in the acquisition of concepts as a result of differences in the representational complexity of pretend episodes versus false beliefs (Gopnik & Slaughter, 1991). According to this view, beliefs need only represent the world, although they may or may not reflect

the true state of the world. In contrast, pretend acts are never meant to stand for reality and therefore are implicitly understood as false representations of reality.

Other theorists argue that pretence skills are independent of representational understanding, proposing instead that pretend acts are differentiated from other acts of mentalising by accompanying overt physical actions or by an “acting-as-if” principle (Harris & Kavanaugh, 1993; Lillard, 1993a; Perner, 1991). According to this view, children do not need to recognise pretence as representation but rather as an action taken “as-if” the situation might be true. Beliefs and pretences are thus indistinguishable to the young child and misrepresentation, as in the case of false belief, may never be acknowledged correctly. The simulationist perspective supports the notion that pretence does not require an understanding of representational components. The simulation theory posits that pretence exists as an activity rather than as a representational mentalistic function to the young child. Thus, pretend attributions, like belief attributions, would be off-line events, in that children automatically default to imagining the pretend situation and reason accordingly (Harris, 1994). False beliefs pose more difficulty for the young child in that a default setting oriented to reality must be overridden (Currie, 1998).

Experiment 4 was designed to explore further the relationship between false belief, reality reasoning and pretence. The first aim of this experiment was to use a novel empirical paradigm to assess young children's performance on false belief, non-mental counterfactual situations and future hypothetical reasoning. Previous research assessing these capabilities found counterfactual reasoning to be correlated with false belief performance, suggesting that a general deficit in reasoning about counter-to-fact situations may underlie false belief task failure (Riggs et al., 1998). A second aim of this study was to investigate the impact of pretence on young children's performance on false belief, counterfactual and future hypothetical questions.

Children lacking a representational understanding of mind would not be expected to pass false belief attributions, regardless of a pretend context. False belief success on tasks embedded in pretence would provide further evidence against a representational-understanding deficit hypothesis. Two pretence conditions whereby children were asked to imagine or pretend the various events depicted in false belief, counterfactual and future hypothetical situations were utilised. The third aim of Experiment 4 was to assess the impact of reality tracers on young children's pretence performance. Recent research has shown that the facilitative effects of pretence on false belief performance may be diluted in the presence of strong reality tracers (Cassidy, 1998). In this study, a second pretence condition included a physical-reality tracer in an attempt to assess possible dissociations in performance between the standard and pretence conditions.

In contrast to the findings of Riggs et al. (1998), this study demonstrated that the *standard* condition tasks of false belief, counterfactual reasoning and future hypothetical reasoning were of equal difficulty. Counterfactual reasoning performance was consistently high for children in the *standard* condition and in both of the *pretence* conditions. Conversely, false belief performance was much lower for the children in the *standard* and *pretence-reality tracer* conditions. It was argued in chapter 5 that these findings do not support Riggs et al.'s (1998) proposal that young children's difficulty with false belief can be explained by a more general difficulty in reasoning counterfactually. This suggests that it is something other than the counterfactual nature of the false belief test questions which poses difficulty for young children. False belief performance for the children in the *pretence-no reality tracer* condition was significantly greater than in the *standard* and *pretence reality-tracer* conditions. This finding replicates previous false belief facilitation effects under the condition of pretence in the existing literature (Cassidy, 1998; Hickling et al., 1997). This finding, it was concluded, provides further support for the notion that

the context of pretence in the absence of a strong reality tracer may bolster young children's false belief performance. Such facilitative effects of the pretend context on young children's false belief performance, it was argued, contradict the representational deficit hypothesis. The pretend false belief attribution process would still have required the child to set aside his or her own representation of reality to reason about the protagonist's current representation of reality as such.

The findings of this study provide some support for the simulationist account. Pretence, in this view, is a prerequisite for simulation. Success in the *pretence-no reality tracer* condition would be expected, given the reduced perspective-shifting demands with limited interference from reality. The act of pretence, according to the simulation account, also serves as an external cue that real-world knowledge does not apply. The context of pretence therefore reduces the processing demands necessary to simulate adequately another's perspective of the world. In the presence of a strong reality tracer, however, the pretend context is not sufficient to override the child's default setting, which is based on his current knowledge of the world. The act of pretence itself is not sufficient to facilitate the simulation process: specific conditions of pretence which provide little interference from reality are required. Pretence, therefore, may not be as crucial to mentalising success as it is portrayed to be in the simulation theory.

It was concluded that the pretence-facilitation effect of this study may be accounted for by information-processing accounts of mentalising, namely Mitchell's (1994, 1996) reality masking hypothesis and Russell et al.'s (1991) executive inhibition hypothesis. Young children, in these accounts, show a general predisposition to be drawn to or fail to inhibit a prepotent response directed toward reality. The differential pretence-facilitation effect for only those children in the *pretence-no reality tracer* group supports these views. Despite a pretend context, in

the presence of a reality tracer, performance was as low as that in a standard false belief condition. This difference in performance between the two pretence groups suggests that it is not pretence *per se* that facilitated false belief performance, but the reduction in the salience of current reality in combination with pretence which influenced performance.

Experiment 4 was a multidimensional study designed to test several elements within a single empirical paradigm, including the relationship between false belief, counterfactual and future hypothetical reasoning, as well as the influence of a pretence context on these abilities. It was acknowledged in chapter 5 that this study may have made unreasonably heavy processing demands on participants. Experiment 5 employed a novel empirical paradigm designed reduce the task demands required for task success in Experiment 4 in attempt to replicate the pretence-facilitation effect. In this study, all children observed two object transfers, one embedded in pretence, the other following standard location change procedures. Each participant was asked only one test question, either a pretence false belief question or a standard false belief question. Based on the pretence-facilitation effect observed in Experiment 4, it was hypothesised that the pretence group would outperform the standard group on the false belief test question. This finding, however, was not replicated in Experiment 5: no significant between-group differences in false belief performance were observed.

One difference between Experiment 4 and Experiment 5 was that, in the latter case, a real object was present throughout the testing scene for the standard transfer; although the children were not directly questioned about this object, its presence may have interfered with their ability to entertain the pretence episode. In Experiment 4, the introduction of a reality tracer significantly reduced false belief success in the pretend context. Despite the failure to replicate the pretence-facilitation effect, it is argued that the findings of Experiment 5 were not necessarily in direct conflict with

those of Experiment 4. The reality tracer in Experiment 5 was not directly related, as it was in Experiment 4's *pretence-reality tracer* condition, to the act of pretence on which the children were tested. Nevertheless, a reality tracer was, in effect, present as part of the "real object" transfer portion of the scenario. It is possible that a child's propensity to be drawn to the true state of affairs is more powerful than the act of pretence of which they were questioned. This finding suggests that the mere presence of an indirect reality tracer may produce enough interference to have a negative effect on the performance of the task. In chapter 6, it was argued that the failure to replicate in Experiment 5 the pretence-facilitation effect found in Experiment 4 does not constitute evidence to refute the reality bias explanations of Mitchell (1994) and Russell et al. (1991). Instead, these results suggest that children may have a genuine difficulty inhibiting their current stance on reality during tasks of mentalising.

Post hoc analyses of the Experiment 5 data revealed that the children who failed the test question in both conditions showed a tendency to be drawn to the current location of the "real" object or to the current location of the "pretend" object when responding. This finding is in line with the reality bias hypothesis of Mitchell (1994) and Russell et al. (1991). Two of the three possible incorrect responses comprised the vast majority of the errors committed by children in this study. In both of these responses, the current location of the object of transfer is chosen. The fact that children persisted in selecting these two types of responses raises the possibility of a more general non-mentalising limitation of executive function. It was argued in chapter 6 that the findings of Experiment 5 support this explanation. The children, regardless of condition, were likely to be drawn to the two current locations of the objects of transfer. This suggests the possibility that the children were incapable of updating their knowledge of the situation while bearing in mind their old knowledge of the locations of the objects.

7.1 Theoretical Discussion

The aim of this thesis has been to explore and empirically evaluate contemporary theories of mentalising development. There has been much philosophical debate over the putative cognitive-developmental mechanisms of mentalising. As a consequence of the methodological difficulties in assessing the internal components of mentalising, however, there have been few empirical studies to support these theoretical arguments.

Traditionally, mentalising theorists have fallen into supposedly mutually exclusive camps, namely the theory theory and simulation perspectives. A third group of researchers advocating for an information-processing explanation of mentalising development has more recently entered into the theoretical debate. The information-processing approach differs from the simulation and theory theory views in two respects. First, in contrast to the developmental theory theory (e.g. Astington & Gopnik, 1991a; Fodor, 1992; Gopnik & Meltzoff, 1997; Perner, 1991; Wellman, 1990) and the simulation theory (e.g. Goldman, 1989, 1995; Harris, 1992), which arise from existing theories of adult mentalising, the information-processing account (e.g. Frye et al., 1995; Hughes, 1998; Leslie, 1988; Mitchell, 1994, 1996; Riggs et al., 1998; Roth & Leslie, 1998; Russell et al., 1991; Zelazo & Frye, 1996) is purely a developmental viewpoint. There is little emphasis on the philosophy of mental states or on adapting existing theories of adult mentalising to a developmental approach. Rather, the primary focus of the information-processing account is the empirical evaluation of mentalising development. The information-processing approach explores potential associations between the maturation of the cognitive-executive system and mentalising performance in the preschool years. The second respect in which the information-processing account differs from the traditional theory theory and simulation perspectives has to do with methodological issues of mentalising assessment. The strength of the information-processing account, unlike the theory

theory and simulation views, lies with methodological accessibility in hypothesis testing. The lack of empirical tests of the theory theory and simulation perspectives continues to limit the debate to philosophical discussion rather than one of rigorous scientific evaluation.

It is concluded that, in isolation, none of the three theories of mentalising at this time offers a satisfactory explanation of mentalising development. The continued emphasis on theoretical divergence observed in the literature limits the scope of further theoretical progress. A possible resolution to the persistent debate may lie in the analysis of overlap between contemporary theories. Rather than focusing on the points of theoretical opposition between the theory theory, the simulation theory and the information-processing theory, an interactionist approach may be a more useful way of identifying the mechanisms of mentalising development. It is a widely held assumption in the literature that the various theoretical accounts of mentalising development are mutually exclusive. In the present account, this conclusion is reconsidered upon thorough evaluation of the competing hypotheses in an attempt to lay the foundation for an integrated theoretical perspective on mentalising development.

The simulation and theory theories have been considered mutually exclusive largely because the theory-driven mechanism posited by the theory theory and the process-driven mechanism of perspective shifting coupled with off-line decision making of the simulation theory have been regarded as incompatible. Close consideration of these theories, however, suggests that the two theoretical positions do not necessarily lie in direct opposition. An alternative interpretation of the divergent perspectives suggests that the simulation theory offers a description of the cognitive mechanism that underpins the processes of mentalising and the theory theory details the information which drives this mechanism.

The theory theory posits that mentalising understanding is premised on an internally represented folk-psychological theoretical framework about the function and structure of the human mind (Carruthers, 1996; Fodor, 1987; Gopnik & Meltzoff, 1997; Perner, 1991; Wellman, 1990). The attribution process draws from an implicitly held set of laws grounded in an everyday base theory of human behaviour (Stich & Nichols, 1992). It is a mistake to assume that the simulation hypothesis does not allow for the possibility that theoretical knowledge may play an active role in mentalising, for the simulation perspective makes no such claim. It is readily conceded that theoretical knowledge may drive the simulation process (Goldman, 1989, 1995; Heal, 1996). For example, it is acknowledged that heuristic generalisations are formulated through direct experience of regularities in behaviours associated with particular persons or situations. These scripts or schemes are said to be accessed frequently during the process of simulation (Gordon, 1989, 1995). The utilisation of heuristic generalisation is considered advantageous to the simulation process. The decision making system will produce reliable simulated outputs when inputs representative of the target individual's current mental state are entered into the decision-making system (Harris, 1992). When the system fails, the fault lies at the level of input. If the simulator agent's perspective shifting is inadequate in adopting the perceptual reality of the target agent, unrepresentative inputs will be entered in the system. In such instances the decision generated will not adequately portray the target agent's likely plan of action or mental state. It stands to reason that acquired knowledge and experience of human behaviour is exploited during the perspective shifting stage of the simulation. For example, such background knowledge enables the target agent's habits or idiosyncrasies to be taken into account when simulating, subsequently easing the burden of the perspective shifting process.

Simulation theorists do not deny the influence of theoretical knowledge on mentalising; rather, theoretical knowledge is denied as the *primary* mechanism of mentalising as proposed by the theory theory (Goldman, 1989; 1995; Heal, 1996). Theory theorists fail to provide a plausible mechanism of *how* the cognitive system, once the relevant information from the theoretical knowledge base has been accessed, generates mental attributions. The simulation account describes a mechanism by which this information is exploited during mentalising: the key to a successful attribution lies in perspective shifting stage of the simulation process (Harris, 1992). Adequate adjustments for relevant differences in perceptual reality, which closely match the starting state of the target individual, are crucial to the attribution process (Goldman, 1989, 1995; Gordon, 1986, 1996; Harris, 1989, 1992). By imaginatively pretending to be in another's place, and attempting to take into account the target individual's perceptual reality, an off-line decision is generated for attribution to another.

The simulation account maintains that the ability to shift frames requires the ability to "pretend" or imagine the simulation perspective of another. Several studies using "picture posting" (Freeman & Lacohee, 1995; Mitchell & Lacohee, 1991), "thought bubble cueing" (Wellman et al., 1996) and "picture in head" training schemes (McGregor et al., 1998; Swettenham et al., 1996) have suggested that imagery may facilitate false belief performance. The facilitative effect of thought bubble cueing on false belief performance found in Experiment 3 is consistent with the simulation idea that imagery may play a significant role in mentalising.

The simulation notion that an individual's own decision-making process is exploited in an off-line manner for mentalising has considerable cognitive-theoretical appeal, since it obviates the need to invoke a separate cognitive mechanism. Decision-making mechanisms are by nature similar enough across individuals to

produce matching outputs so long as the inputs entered into the process also match (Heal, 1996). It seems implausible that the process of mentalising is governed *purely* by an internally represented set of laws and rules of the domain without such a cognitive mechanism to make use of the accessed theoretical knowledge. The theory theorists have yet to provide a substantive argument detailing how the proposed theoretical mechanism operates during mentalising. Undoubtedly, theoretical knowledge is important for the mentalising processes; however, the theory theory falls short of explaining how or what cognitive mechanism results in end state mentalising capacities. When taken in isolation, the theory theory perspective details *what* information is utilised, but fails to articulate *how* this information is used by the cognitive system during mentalising. In contrast, the simulation theory describes *how* the information is incorporated during perspective shifting and used by the decision-making systems to generate off-line attributions. Consolidation of these theoretical perspectives provides a more plausible explanation of the mentalising process than is offered by either independently: the cognitive mechanism of simulation may be driven by theoretical knowledge.

There is also considerable theoretical overlap between the simulation and information-processing accounts of mentalising. Both views advocate that false belief failure in the preschool years is symptomatic of the heavy task demands required for success, rather than a reflection of the children's capacity for mentalising (Harris, 1992; Leslie & Polizzi, 1998; Mitchell, 1996; Russell et al., 1991). The simulation theory posits that, as the ability to make use of imaginative identification increases throughout the preschool years, children overcome the heavy processing demands of standard false belief tasks (Harris, 1996). Once children develop the ability to generate sophisticated pretend or imaginary inputs for entry in the executive decision-maker, they are freed from their own perceptual stance on reality. Once this is

achieved, they may reason about a perspective of reality which conflicts with their own without interference (Harris, 1992). In this view, false belief tasks are of particular difficulty for young children because they require sophisticated perspective shifting abilities. First, the children must acknowledge the idiosyncratic mental state of the protagonist. Second, children must imagine what it is like not to know the current state of affairs. Finally, they must generate a response based on the adjusted inputs and attribute this to the protagonist in order to show success (Harris, 1991).

Following a similar rationale, information-processing accounts of mentalising predominantly focus on attempting to explain young children's mentalising errors in terms of maturation of the cognitive system. Specific tendencies for children to exhibit realist errors on standard tasks of false belief, in this view, are a function of executive information-processing and practical reasoning task demands rather than a reflection of children's mentalising capacities *per se* (Leslie, 1994; Mitchell, 1996; Russell et al., 1991). Like the simulation perspective, information-processing accounts of mentalising posit that false belief failure in the preschool years is explained in terms of executive performance limitations (Surian & Leslie, 1999).

The strength of the information-processing approach comes from the increasing amounts of evidence showing that mentalising success is related to the computational resources required for a particular task in relation to the availability of those particular resources at a specific stage of development. Evidence showing more general processing constraints on mentalising performance comes from the findings of novel and modified empirical paradigms designed to require similar nonmentalising processing demands to those of standard false belief tasks. These studies consistently demonstrate that children have a broader difficulty overcoming the processing demands of standard tasks, regardless of whether the content is mental or not (Frye et al., 1995; Leslie & Roth, 1998; Riggs et al., 1998). A recent investigation has also

shown performance on false belief tasks correlates with executive inhibitory control and working memory (Hughes, 1998). Studies have also produced evidence that performance is enhanced when the processing demands of standard false belief tasks are reduced. These facilitative techniques include “picture posting” (Freeman, 1994; Freeman & Lacohee, 1995; Mitchell & Lacohee, 1991; Robinson & Mitchell, 1995) and the context of pretence (Cassidy, 1998; Hickling et al., 1997). In Experiment 4, a pretend context had a facilitative effect on false belief performance, but this finding was only observed in the absence of a reality tracer within the pretend context.

Common to all is that the salience of reality is reduced. Similarly, in Experiment 5, the presence of a strong reality tracer, despite the pretend context, impaired false belief performance. The findings obtained by previous research, taken together with those of Experiments 4 and 5, suggest that children have a genuine difficulty in negotiating the processing demands required to override the salience of the true state of affairs during false belief tasks. This explanation is in line with Mitchell’s (1994) and Russell et al.’s (1991) reality bias explanations of false belief failure in the preschool years.

The notion that executive maturation is intimately related to mentalising performance has important implications for any account of the mechanism operating in the production of mental state attributions and behaviour prediction. It is clear from the empirical evidence cited above that when the information-processing task demands of standard false belief paradigms are manipulated, performance is influenced. It is plausible that mentalising performance, at least as assessed by standard false belief paradigms, depends on acquiring specific nonmentalising executive processes. It is less clear from these findings how executive skills are associated with the general mechanism which underlies the capability for mentalising, if, indeed, they are. While associations of executive functioning with false belief

performance have heuristic value in identifying necessary prerequisite executive skills for success on standard mentalising tasks, these associations reveal little about mentalising abilities in general. Leaving the executive function requirements aside, the information-processing position fails to articulate *how* maturation of the cognitive system results in end state mentalising abilities.

An alternative explanation would be to provide an integrated account of mentalising development that incorporates the fundamental proposals of the theory theory, the simulation theory and the information-processing theory into a single explanatory framework. A consolidated model combining the theoretical overlap with empirical evidence might explain mentalising more plausibly and thoroughly than it has been to date. Such an account might borrow the theory theory's idea that the mentalising mechanism relies on the input of theoretical knowledge when attributing mental states. The theoretical knowledge describes how the information is encoded and accessed at a representational level. The simulation theory provides a detailed account of the cognitive system which utilises the representational output of the theoretical knowledge base during perspective shifting. The perspective shifting mechanism is considered to be driven by the representational content, organised and encoded by the theoretical system. Finally, the information-processing account has successfully identified the executive components that enable operation of the mentalising mechanism.

It is acknowledged that this explanatory framework may be considered a rather simplistic explanation of mentalising. Nevertheless, this example serves to illustrate the strength that an integrated approach may have in furthering theoretical discussion and research in the field. Rather than perpetuating the theoretical standstill between the divergent perspectives on mentalising development, it is advocated that researchers draw on the theoretical overlap and empirical evidence to advance

research in the field. Such an approach, it is argued, is crucial to identifying with precision the mechanisms that underlie mentalising capabilities and their development.

7.1 General Methodological Issues

Although the empirical studies presented here revealed certain relationships between mentalising capabilities, false belief understanding, pretence and imagery, the cognitive-developmental mechanisms that underpin these relationships were not conclusively identified. Nevertheless, the novel empirical approach adopted, which attempted to assess the validity of contemporary theories of mentalising development, was the strength of this project. Traditional theoretical discussions of mentalising development are often limited to *post hoc* evaluations of the findings of standard mentalising assessment paradigms. Debate over the mechanisms of mentalising development has been dominated by competing attempts to explain false belief failure in the preschool years. This *post hoc* approach, although useful, has not proved sufficient to resolve the theoretical debate. The lack of research attempting to test the theoretically divergent *a priori* predictions of mentalising development has been a limitation of this field.

7.1.i Methodological Limitations

The assessments used here aimed to manipulate standard testing paradigms in accordance with the different predictions of various theoretical views of mentalising development. That is, a series of empirical investigations based on theoretically divergent *a priori* hypotheses were designed to evaluate the validity of the simulation, information-processing and theory theories of mentalising. To this end, this project evolved as a series of systematic investigations, each building on the perceived theoretical implications of the previous study's findings. This approach resulted in a research project encompassing a vast theoretical scope. In hindsight, it is apparent

that attempting to evaluate three major theories of mentalising in a comprehensive fashion may have been impractical. Rather than undertaking to put all three theories of mentalising to the test in tandem, an in-depth evaluation of a specific theory of mentalising, while less ambitious, would have been more likely to yield conclusive results.

A similar criticism of the research presented in this thesis has to do with its use of complex empirical designs. Particularly in Experiments 3 and 4, the empirical designs included multiple independent and dependent variables. These studies attempted to test several aims and hypotheses within single testing paradigms. It is acknowledged, in retrospect, that such an ambitious research strategy may not have yielded the clearest or most conclusive findings. Experiment 3, for example, included a multidimensional design aimed at investigating the influence of the direction of the false belief prediction, action-to-belief or belief-to-action, on both true and false belief performance. The potential impact of thought bubble cueing on each type of belief prediction performance was also included in the testing paradigm. Similarly, in Experiment 4, a novel testing paradigm incorporated single testing scenarios designed to assess false belief, future hypothetical, and counterfactual reasoning. In addition, experimental conditions were added to these scenarios to assess the impact of pretence, with and without reality tracers, on performance. The complex nature of the empirical designs utilised in these investigations resulted in, at times, less than clear results. Ideally, these variables should have been assessed in isolation. Separate empirical investigations of each of these variables may have generated more conclusive findings than those presented here.

A second limitation to the multidimensional paradigms used here is the possibility that, as a consequence of adapting standard false belief assessments to the empirical strategies described above, information-processing demands for task

success may have been increased. This criticism is particularly relevant to the procedures of Experiment 4. It is possible that the testing scenario scripts were too lengthy and, at times, difficult for young children to follow. Despite the inclusion of control questions, it is difficult to conclude with certainty whether the children adequately understood the nature of the test question when responding. One possibility is that they misinterpreted the test question. For example, when asked about the protagonist's view on the location of the pretend object, they may have responded as if they were asked about the real object or vice versa. Furthermore, the lengthy scripts may have made it difficult for the children to keep in mind the rule sorting procedures of the object transfer while responding to counterfactual, future hypothetical, and false belief test questions. It is also possible that the children may have misunderstood or overlooked crucial details of the test questions. The differences between the future hypothetical, false belief, and counterfactual test questions were subtle and therefore may not have been recognised. The adverse impact of these task demands on performance is likely to have been increased under the pretence conditions of Experiments 4 and 5. In these studies, the children were required to engage in experimenter-led pretence and, simultaneously, attend to the subtleties of the testing script. It is acknowledged that these methodological design limitations may have confounded the findings obtained.

7.1.ii Future Research

A number of possible avenues should be explored in future research. Further mentalising training studies testing different theoretical predictions are required to investigate the malleability of mentalising development and to identify possible cognitive-developmental stages at which performance may be enhanced. Successful training methodologies would arguably provide the most conclusive evidence to support different theoretical predictions. Boosting mentalising performance in

accordance with a specific theoretical expectation would provide strong evidence in support of that perspective. Although methodologically appealing, training studies, as longitudinal experiments, require long-term assessment and follow-up. Furthermore, considerable experimenter-to-participant contact time is necessary for pre- and post-testing assessment as well as for training sessions. Despite these methodological practicalities, it is held that further training studies should be attempted, because a positive generalised training result would reveal the most conclusive evidence for the underlying mechanisms of mentalising development.

An attempt to replicate the impact of thought bubble cueing and other sources of visual cueing, as well as the effects of pretence, on mentalising performance is necessary, as is a re-examination of the relationship between false belief performance and reality tracers in both real and pretend contexts. Ideally, the experimental approach to these issues would include the utilisation of separate paradigms, specifically designed to measure each type of variable in isolation with minimal task demands. Replication of the findings presented here is necessary before any theoretical conclusions pertaining to contemporary views of mentalising can be firmly drawn. Moreover, standardisation of the novel paradigms, particularly of those from Experiments 3 through 5, is required to establish the validity and reliability of the measures utilised here.

Arguably the most significant methodological implication of this discussion relates to the use of standard of false belief paradigms as valid assessments of mentalising performance. The unexpected transfer Maxi false belief paradigm devised by Wimmer and Perner (1983) and Perner et al.'s (1987) deceptive box Smarties false belief task are widely used mentalising assessments. These tasks aim to assess the young child's ability to make an accurate prediction of a protagonist's action based on an outdated belief which is contrary to what the child knows to be the

true state of affairs. Success on such tasks has come to define a crucial stage in mentalising development: the sophisticated understanding of how beliefs influence behaviour (Davies & Stone, 1995). The advent of such paradigms resulted in a surge of theoretical discussion of the cognitive-developmental implications of the findings of these false belief assessments. Interest in the negative results obtained by false belief assessments as a reflection of general mentalising deficiency remains a primary focus of mentalising research. In light of the increasing amounts of evidence showing associations between executive function and false belief performance, it is argued that continued reliance on such assessments as a valid indication of mentalising performance may be a fundamentally misguided approach. Mentalising researchers should stop speaking of false belief success in static terms where failure indicates a general deficit in mentalising capabilities. Indeed, advances made by recent research have stimulated a shift toward an information-processing strategy for explaining false belief failure in the preschool years. One of the most important implications of recent research is the considerable extent to which false belief tasks may rely on executive skills rather than on mentalising abilities. If the field is to progress, it is essential that the theories and methodologies used to assess mentalising capacities recognise this fact. The methodological implications of such a view are clear. Assuming that false belief success is regulated through executive abilities, false belief assessment is unlikely to show anything of real interest before the maturation of the prerequisite skills necessary to overcome false belief task demands.

Future research should continue the approach of devising novel empirical measures to assess *a priori* predictions of theories of mentalising rather than relying on *post hoc* discussions of the findings of traditional false belief assessments. A study that independently examined the contributing variables to mentalising performance predicted by different theories of mentalising, in isolation, would thereby offer a way

of identifying the underlying components of mentalising development. Furthermore, a de-emphasis of the potential theoretical implications of false belief failure and increased interest in the design of empirical paradigms, which provide valid assessments of mentalising abilities, is advocated. Research of this sort is essential if we are to fully identify and explain the processes of mentalising development. Rejecting the reliance on traditional *post hoc* interpretations of false belief failure in the preschool years will ultimately lead to more practical hypotheses of development than currently offered in contemporary mentalising research and theory.

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APPENDICES

APPENDIX I

Chapter Two

False Belief Pre- and Post-Test Scripts

Unexpected Transfer Maxi Task (Wimmer & Perner, 1983)

Set I

(The child is introduced to two dolls)

“This doll is called Jackie and this doll is called Liz.”

Control Naming Question: *“Can you tell me the names of these two dolls?”*

“Jackie places her marble in the green box and then she goes outside to play.”

(Exit Jackie)

Control Memory Question: *“Where did Jackie put her marble before she went out to play?”*

“While Jackie is away, Liz takes the marble from the green box and moves it to the yellow box. Jackie now returns for her marble.”

(Return Jackie)

Test Question: *“Where does Jackie think her marble is?”* (Correct response: green box)

Reality Control: *“Where is the marble really?”* (Correct response: yellow box)

Set II

(The child is introduced to two dolls)

“This doll is called Ben and this doll is called Ricky.”

Control Naming Question: *“Can you tell me the names of these two dolls?”*

“Ben places his money in the blue box and then goes outside to play.”

(Exit Ben)

Control Memory Question: *“Where did Ben put his money before he went out to play?”*

*“While Ben is away, Ricky takes the money from the blue box and moves it to the red box.
Ben now returns for his money.”*

(Return Ben)

Test Question: “Where does Ben think his money is?” (Correct response: blue box)

Reality Control: “Where is the money really?” (Correct response: red box)

<u>Deceptive Box Smarties Task (Perner et al. 1987)</u>
--

Set I

(The child is shown Smarties tube)

“What do you think is inside this tube?”

(Tube is opened to reveal that it contains coins)

Reality Control Question: “Now what do you think is inside the tube?”

“Self” Belief Question: “When I first showed you the tube, before we opened it, what did you think was inside? (Correct response: Smarties)

(Child is introduced to fluffy toy)

“Other” Belief Question: “This is Franky Frog. He did not see what was inside of the tube. What does Franky think is inside the tube?” (Correct response: Smarties)

Set II

(The child is shown plasters box)

“What do you think is inside this box?”

(Box is opened to reveal that it contains birthday cake candles)

Reality Control Question: “Now what do you think is inside the box?”

“Self” Belief Question: “When I first showed you the box, before we opened it, what did you think was inside? (Correct Response: plasters)

(Child is introduced to fluffy toy)

“Other” Belief Question: “This is Billy Bear. He did not see what was inside of the box. What does Billy think is inside the box?” (Correct response: plasters)

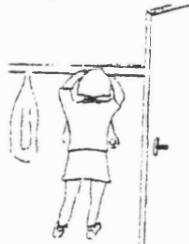
APPENDIX II

Chapter Two

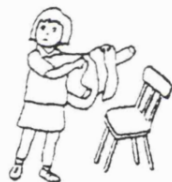
Remaining False Belief Training Scripts from the Explanation Section of the Training

Scenario II

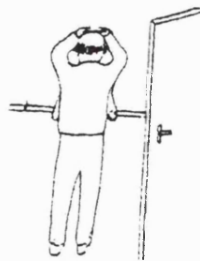
Frame 1: This is Missy. Missy is getting ready to go outside and play. She is getting her coat from the cupboard.



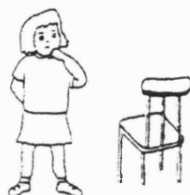
Frame 2: But Missy hears the doorbell ringing (*bing-bong, bing-bong*) so she carefully places her coat on the chair to keep it safe. Then off she goes to answer the door.



Frame 3: While Missy is away answering the door, Missy's dad takes her coat from the chair and *moves* it back into the cupboard.



Frame 4: Missy has finished answering the door and returns for her coat. She remembers carefully placing her coat on the chair and returns to the chair to get it. Missy is very surprised because Oh No it's not there!

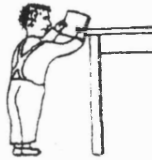


Scenario III

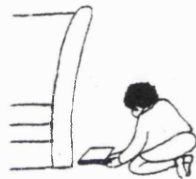
Frame 1: This is Greg. Greg is reading a book.



Frame 2: But Greg is thirsty now so he carefully places his book on the table to keep it safe. Then off he goes to get a cup of water.



Frame 3: While Greg is away getting a cup of water, Greg's little brother takes his book from the table and *moves* it to the floor by the sofa.



Frame 4: Greg has finished getting a cup of water and returns for his book. He remembers carefully placing his book on the table and returns to the table to get it. Greg is very surprised because Oh No it's not there!



Scenario IV

Frame 1: This is Sharyn. Sharyn is writing a letter.



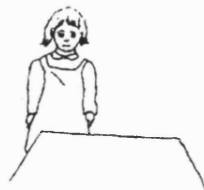
Frame 2: But Sharyn hears the telephone ringing (*bring-bring, bring-bring*) so she carefully places her letter on the table to keep it safe. Then off she goes to answer the telephone.



Frame 3: While Sharyn is away answering the telephone, Sharyn's mum takes her letter from the table and *moves* it to the shelf that is up high.



Frame 4: Sharyn has finished talking on the telephone and returns for her letter. She remembers carefully placing her letter on the table and returns to the table to get it. Sharyn is very surprised because Oh No it's not there!



APPENDIX III

Chapter Two

Remaining Training Scenario From the False Belief Prediction Section of the Training Scheme

(Child is introduced to a doll)

"This is Bill."

(Doll is made to look around)

"Bill is looking for his toy aeroplane. First he looks for his aeroplane in his toybox. And there it is! But Oh No it is broken. Bill carefully places the broken aeroplane on his bed where he wants it to stay while he fetches some glue to mend the plane."

Memory Question: *"Where does Bill want his aeroplane to stay while he fetches the glue?"*

Feedback as appropriate: *"Yes, that's right." or "No, Bill wants his aeroplane to stay on his bed."*

(Exit doll. Child is introduced to a second doll)

"This is Amy, she is Bill's little sister."

(Amy doll is made to pick up the plane and move it back to the toybox)

"But look, while Bill is away, Amy takes the aeroplane off of the bed and moves it to the toybox."

Memory Questions: (Feedback as above) *"Where is the aeroplane?"*
"Where did Bill leave his aeroplane at the beginning of the story?"

(Return Bill doll)

"Bill now returns with some glue."

Explanation Question: *"Where will Bill look first for his aeroplane?"*

Feedback Correct Response: *"That's right. Bill is very surprised that his aeroplane is not on his bed."*

Feedback Incorrect Response: *"But I remember placing my aeroplane on my bed. Oh, No! My aeroplane is gone!"* (Doll is then made to look for the aeroplane in the toybox) *"Here is my aeroplane! Somebody tidied my room and took it off of my bed where I left it and moved it to the toybox!"*

APPENDIX IV
Chapter Three

Level-2 Visual Perspective Taking
Pre- and Post-test Scripts

<u>Level-2 Standard Task (Flavell et al. 1981)</u>

Set I

(Child is shown one red strip and one blue strip of paper)

Control Colour Questions: (Experimenter points to red strip) *“What colour is this?”* (Experimenter points to blue strip) *“And what colour is this?”*

(A drawing of a worm is placed horizontally between child and experimenter)

“This is Wally Worm. Sometimes Wally looks like he is lying on the red blanket, like this. (Experimenter places red strip under worm). And sometimes he looks like he is lying on the blue blanket, like this (Experimenter places blue strip under worm).”

“Self” Test Questions: (Experimenter places blue strip under worm and red strip over worm). *“What colour blanket does Wally Worm look like he is lying on from where YOU are sitting?”* (Correct response: blue)

(Experimenter then turns worm drawing upside down). *“What colour blanket does Wally Worm look like he is lying on now from where YOU are sitting?”* (Correct response: red)

“Other” Test Questions: (Experimenter reverses colour strips: red under worm, blue over worm). *“What colour blanket does Wally Worm look like he is lying on from over here where I am sitting?”* (Correct response: blue)

(Experimenter then turns worm drawing upside down). *“What colour blanket does Wally Worm look like he is lying on now from over here where I am sitting?”* (Correct response: red)

Set II

(A drawing of a turtle is placed horizontally between child and experimenter)

“This is Terry Turtle. Sometimes Terry looks like he is standing on his feet, like this. (Experimenter points to turtle’s feet). And sometimes he looks like he is lying on his back, like this (Experimenter turns turtle upside down and points to his back).”

Control Questions:

“Where is Terry’s back?”

“Where are Terry’s feet?”

“Self” Test Questions: (Experimenter places turtle horizontally between child and experimenter). *“Does Terry Turtle look like he is lying on his back or standing on his feet from where YOU are sitting?”* (Correct response: feet)

(Experimenter then turns turtle drawing upside down). *"Now does Terry Turtle look like he is lying on his back or standing on his feet from where YOU are sitting?"*

(Correct response: back)

"Other" Test Questions:

"Does Terry Turtle look like he is lying on his back or standing on his feet from over here where I am sitting?" (Correct response: feet)

(Experimenter then turns turtle drawing right side up). *"Now does Terry Turtle look like he is lying on his back or standing on his feet from over here where I am sitting?"*

(Correct response: back)

<u>Level-2 Policeman Task (Hughes & Donaldson, 1979)</u>

(Policeman doll and boy doll are placed on the table)

"This little boy's name is Roy. He wants to hide from this policeman. The policeman is looking for Roy but Roy wants to hide."

(Child is handed cardboard "wall")

Control Question: *"Put the wall so that the policeman cannot see Roy."* (Correct response: between the boy and policeman, task repeated until correct on three trials)

(Cross-shaped partition consisting of four potential quadrants for "hiding" is placed on the table. The policeman doll is placed at the top of the cross)

Test Question: *"Roy still wants to hide from the policeman. Hide the Roy somewhere in here so that the policeman cannot see him."* (Correct response: either of two directly opposing quadrants).

(Policeman doll is placed at different location and test question is repeated)

(A second policeman doll is then introduced)

"Here is another policeman; he is also looking for Roy. Roy still wants to hide from both of the policemen."

(Policeman dolls are placed at adjacent positions on the partition)

Test Question: *"Hide Roy so that both policemen cannot see him."*

(Policeman dolls are rearranged to another position adjacent to each other and test question is repeated)

Level-2 Rotation Task (Masangkay et al. 1974)

(Three identical tiger toys are placed on table in front of child. One tiger is facing child, one is positioned sideways, and the final tiger is turned around so that his tail end is facing the child. An identical target tiger is placed facing the child)

Control Question: *“Which one of these tigers (Experimenter motions towards three tigers) looks to be standing exactly like this one?”* (Experimenter points to target tiger).

(Target tiger is rotated 90 degrees, facing sideways and the question is repeated. The target tiger is then rotated another 90 degrees with the tail end facing child and test question repeated. Questions are repeated until correct on all three trials)

Self Test Question: (Target tiger is placed to be facing the child). *“Which one of these tigers looks exactly like what YOU see?”* (Correct response: tiger facing child)

Other Test Question: *“Which one of these tigers looks exactly like what I see?”* (Correct response: tiger with tail end to child)

(Target tiger is rotated 90 degrees to be facing sideways and then another 90 degrees with tail end facing child and the test questions are repeated for both positions)

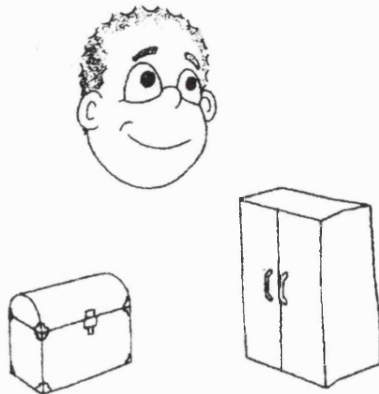
APPENDIX V
Chapter Four

*Remaining True and False Belief Test Questions and
Corresponding Cartoons for Simulation-Cued,
Simulation-Noncued, Theory Theory-Cued and
Theory Theory-Noncued Conditions.*

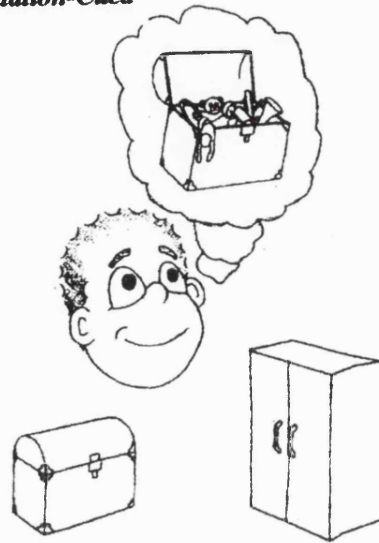
	<u>True Belief Scenario</u>	<u>False Belief Scenario</u>
<u>Simulation-Noncued</u>	Here is Kate. Kate keeps her pencils in this empty milk carton. Kate reaches for the empty milk carton. What will Kate do next?/Will Kate have a drink or draw? <u>Correct Response:</u> Draw	Here is Tony. This is Tony's toy box but while Tony was at school today his mum emptied out all of Tony's toys from the toy box and put them in the cupboard. Tony now returns from school and it's time to play. Where will Tony look first for toys? <u>Correct Response:</u> Toy box
<u>Simulation-Cued</u>	Here is Kate. Kate keeps her pencils in this empty milk carton (thought bubble of pencils in carton). What will Kate do next?/Will Kate have a drink or draw? <u>Correct Response:</u> Draw	Here is Tony. This is Tony's toy box but while Tony was at school today his mum emptied out all of Tony's toys from the toy box and put them in the cupboard. Tony now returns from school and it's time to play (thought bubble of toys in toy box). Where will Tony look first for toys? <u>Correct Response:</u> Toy box
<u>Theory Theory-Noncued</u>	Here is Kate. Kate keeps her pencils in this empty milk carton. Kate reaches for the milk carton. Why is Kate doing that?/What might she be thinking? <u>Correct Response:</u> To get pencils/draw.	Here is Tony. This is Tony's toy box but while Tony was at school today his mum emptied out all of Tony's toys from the toy box and put them in the cupboard. Tony now returns from school and it's time to play. Tony looks in his toy box for his toys. Why is Tony doing that?/What might he be thinking? <u>Correct Response:</u> Toys are in toy box.
<u>Theory Theory-Cued</u>	Here is Kate. Kate keeps her pencils in this empty milk carton. Kate reaches for the milk carton. Which one of these pictures shows what Kate is thinking? (thought bubbles of Kate drinking, Kate drawing.). <u>Correct Response:</u> Get pencils/draw.	Here is Tony. This is Tony's toy box but while Tony was at school today his mum emptied out all of Tony's toys from the toy box and put them in the cupboard. Tony now returns from school and it's time to play. Tony looks in his toy box for his toys. Which one of these pictures shows what Tony is thinking? (thought bubbles of toys in toy box, toys in cupboard). <u>Correct Response:</u> Toys in toy box.

FALSE BELIEF CARTOONS

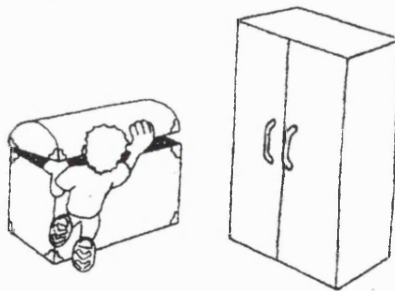
Simulation-Noncued



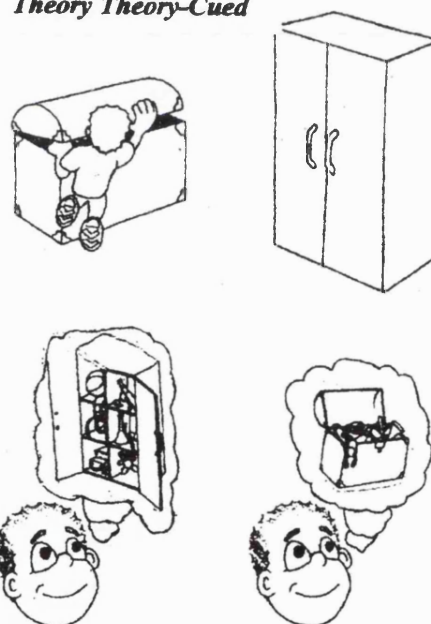
Simulation-Cued



Theory Theory-Noncued

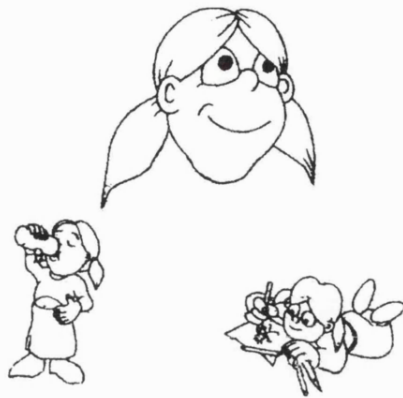


Theory Theory-Cued



TRUE BELIEF CARTOONS

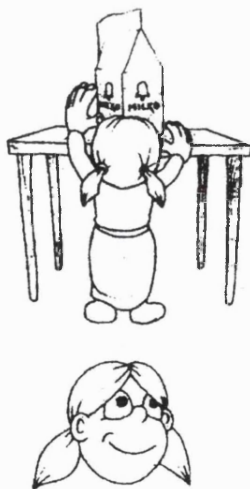
Simulation-Noncued



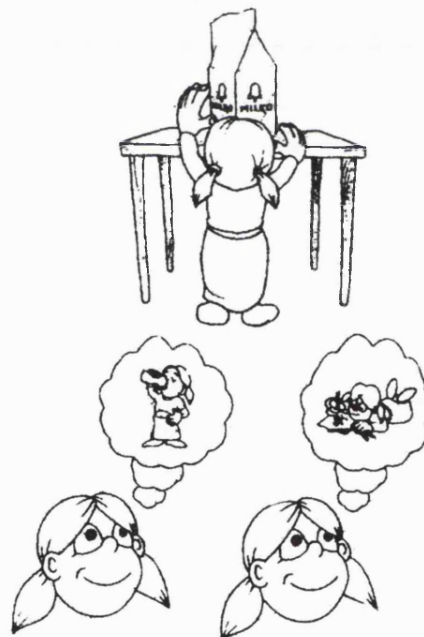
Simulation-Cued



Theory Theory-Noncued



Theory Theory-Cued



APPENDIX VI
Chapter Four

<i>Thought Bubble Warm-up Script and Control Question (Wellman et al. 1996)</i>
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*(Child is introduced to a cartoon drawing of a girl in a frilly dress and boots
with a thought bubble above her head containing flowers)*

“This is Lauri.”

(Experimenter points to Lauri’s boot)

“What’s this?”

(Experimenter points to Lauri’s dress)

“What’s this?”

(Experimenter using a sweeping motion to indicate entire contents of thought bubble)

“What’s this?”

(All responses were confirmed or contradicted by Experimenter)

“This shows you what Lauri is thinking. So what is Lauri thinking?”

(Procedure repeated until correct response is given)

APPENDIX VII
Chapter Five

**Scripts for “Paper” and “Dough” Scenarios for the Standard, Pretence-No
Reality Tracer and Pretence-Reality Tracer Conditions**

PAPER SCENE

Standard Group

“Now let’s play this game with Michael. Michael knows how to play this game, it is his favourite game. Michael has a paper with no picture on it. Michael is going to tidy up so he puts the paper with no picture on it in the ‘paper with no pictures box’. Now Michael is going to go to sleep in my bag.”

(Exit Michael)

“While Michael is asleep in my bag, let’s take the paper with no picture on it out of the ‘paper with no pictures box’”.

False Belief Test and Control Questions

(Experimenter draws a picture on the paper)

“Let’s draw a picture on the paper. Is there a picture on the paper? So I’ll put the paper in the ‘paper with pictures box’. Now Michael wakes up and comes back for his paper.”

(Return Michael)

TEST QUESTION:

“Which box will Michael look in first for his paper?”

Correct response: “paper with no pictures box”

CONTROL QUESTION:

“Which box did Michael leave his paper in at the beginning of the story?”

Correct response: “paper with no pictures box”

Counterfactual Reasoning Test and Control Questions

(Experimenter draws a picture on the paper)

“Let’s draw a picture on the paper. Is there a picture on the paper? So I’ll put the paper in the ‘paper with pictures box’.

TEST QUESTION:

"If I had not drawn a picture on the paper, which box would it be in?"

Correct response: "paper with no pictures box"

CONTROL QUESTION:

"Which box did Michael leave his paper in at the beginning of the story?"

Correct response: "paper with no pictures box"

Future Hypothetical Test and Control Questions

TEST QUESTION:

"If I draw a picture on the paper, which box would it be in?"

Correct response: "paper with pictures box"

CONTROL QUESTION:

"Which box did Michael leave his paper in at the beginning of the story?"

Correct response: "paper with no pictures box"

Pretence-No Reality Tracer Group

"Now let's play this game with Michael. Michael knows how to play this game, it is his favourite game. Let's pretend that Michael has a paper. The pretend paper has no picture on it.

Pretence Control Questions

"Are you pretending with me?"

"Does the pretend paper have a picture on it?"

(If incorrect responses are given for either question the child is asked again to pretend by imagining in his or her head that there is a pretend paper. Procedure is repeated until correct responses are given)

"Michael is going to tidy up so he puts the pretend paper with no picture on it in the 'paper with no pictures box'. Now Michael is going to go to sleep in my bag."

(Exit Michael)

"While Michael is asleep in my bag let's take the pretend paper with no picture on it out of the 'paper with no pictures box'."

False Belief Test and Control Questions

(Experimenter mimes drawing a picture on the "pretend" paper)

"Let's pretend to draw a picture on the pretend paper. Is there a pretend picture on the pretend paper? So I'll put the paper in the 'paper with pictures box'. Now Michael wakes up and comes back for his pretend paper."

(Return Michael)

TEST QUESTION:

"Which box will Michael look in first for his pretend paper?"

Correct response: "paper with no pictures box"

CONTROL QUESTION:

"Which box did Michael leave his pretend paper in at the beginning of the story?"

Correct response: "paper with no pictures box"

Counterfactual Reasoning Test and Control Questions

(Experimenter mimes drawing a picture on the pretend paper)

"Let's pretend to draw a picture on the pretend paper. Is there a pretend picture on the pretend paper? So I'll put the pretend paper in the 'paper with pictures box'."

TEST QUESTION:

"If I had not drawn a pretend picture on the pretend paper, which box would it be in?"

Correct response: "paper with no pictures box"

CONTROL QUESTION:

"Which box did Michael leave his pretend paper in at the beginning of the story?"

Correct response: "paper with no pictures box"

Future Hypothetical Test and Control Questions

TEST QUESTION:

"If I pretend to draw a pretend picture on the pretend paper, which box would it be in?"

Correct response: "paper with pictures box"

CONTROL QUESTION:

"Which box did Michael leave his paper in at the beginning of the story?"

Correct response: "paper with no pictures box"

Pretence-Reality Tracer Group

"Now let's play this game with Michael. Michael knows how to play this game, it is his favourite game. Michael has a paper with no picture on it. "Michael is going to tidy up so he puts the paper with no picture on it in the 'paper no with pictures box'. Now Michael is going to go to sleep in my bag."

(Exit Michael)

"While Michael is asleep in my bag let's take the paper with no picture on it out of the 'paper with no pictures box'."

False Belief Test and Control Questions

(Experimenter mimes drawing a picture on the paper)

"Let's pretend to draw a picture on the paper. Is there a pretend picture on the paper?"

Pretence Control Questions

"Are you pretending with me?"

"Does the paper have a pretend picture on it?"

(If incorrect responses are given for either question the child is asked again to pretend by imagining in his or her head that there is a pretend picture on the paper. Procedure is repeated until correct responses are given)

"So I'll put the paper with the pretend picture on it in the 'paper with pictures box'. Now Michael wakes up and comes back for his paper."

(Return Michael)

TEST QUESTION:

"Which box will Michael look in first for his paper?"

Correct response: "paper with no pictures box"

CONTROL QUESTION:

"Which box did Michael leave his paper in at the beginning of the story?"

Correct response: "paper with no pictures box"

Counterfactual Reasoning Test and Control Questions

(Experimenter mimes drawing a picture on the paper)

"Let's pretend to draw a picture on the pretend paper. Is there a pretend picture on the paper?"

Pretence Control Questions

"Are you pretending with me?"

"Does the paper have a pretend picture on it?"

(If incorrect responses are given for either question the child is asked again to pretend by imagining in his or her head that there is a pretend paper. Procedure is repeated until correct responses are given)

"So I'll put the paper in the 'paper with pictures box'."

TEST QUESTION:

"If I had not drawn a pretend picture on the paper, which box would it be in?"

Correct response: "paper with no pictures box"

CONTROL QUESTION:

"Which box did Michael leave his paper in at the beginning of the story?"

Correct response: "paper with no pictures box"

Future Hypothetical Test and Control Questions

TEST QUESTION:

"If I pretend to draw picture on the paper, which box would it be in?"

Correct response: "paper with pictures box"

CONTROL QUESTION:

"Which box did Michael leave his paper in at the beginning of the story?"

Correct response: "paper with no pictures box"

DOUGH SCENE

Standard Group

"Now let's play this game with James. He knows how to play this game, it is his favourite game. James has some round dough. James is going to tidy up so he puts the round dough in the 'round dough box'. Now James is going to go to sleep in my bag."

(Exit James)

"While James is asleep in my bag, let's take the round dough out of the 'round dough box'."

False Belief Test and Control Questions

(Experimenter makes the dough long)

"Let's make the dough long. Is the dough long? So I'll put the long dough in the 'long dough box'. Now James wakes up and comes back for his dough."

(Return James)

TEST QUESTION:

"Which box will James look in first for his dough"

Correct response: "round dough box"

CONTROL QUESTION:

"Which box did James leave his dough in at the beginning of the story?"

Correct response: "round dough box"

Counterfactual Reasoning Test and Control Questions

(Experimenter makes the dough long)

"Let's make the dough long. Is the dough long? So I'll put the long dough in the 'long dough box'."

TEST QUESTION:

"If I had not made the dough long which box would it be in?"

Correct response: "round dough box"

CONTROL QUESTION:

"Which box did James leave his dough in at the beginning of the story?"

Correct response: "round dough box"

Future Hypothetical Test and Control Questions

TEST QUESTION:

"If I make the dough long which box would it be in?"

Correct response: "long dough box"

CONTROL QUESTION:

"Which box did James leave his dough in at the beginning of the story?"

Correct response: "round dough box"

Pretence-No Reality Tracer Group

"Now let's play this game with James. He knows how to play this game, it is his favourite game. Let's pretend that James has some dough. The pretend dough is round."

Pretence Control Questions

"Are you pretending with me?"

"Is the pretend dough round or long?"

(If incorrect responses are given for either question the child is asked again to pretend by imagining in his or her head that there is some pretend dough that is round.

Procedure is repeated until correct responses are given)

"James is going to tidy up so he puts the pretend round dough on it in the 'round dough box'. Now James is going to go to sleep in my bag."

(Exit James)

"While James is asleep in my bag let's take the pretend round dough out of the 'round dough box'."

False Belief Test and Control Questions

(Experimenter mimes making the dough round)

“Let’s pretend to make the pretend dough long. Is pretend dough long?” “So I’ll put the dough in the ‘long dough box’. Now James wakes up and comes back for his pretend dough.”

(Return James)

TEST QUESTION:

“Which box will James look in first for his pretend dough”

Correct response: “round dough box”

CONTROL QUESTION:

“Which box did James leave his pretend dough in at the beginning of the story?”

Correct response: “round dough box”

Counterfactual Reasoning Test and Control Questions

(Experimenter mimes making the “pretend” dough long)

“Let’s pretend to make the pretend dough long. Is the pretend dough long?”

Pretence Control Questions

“Are you pretending with me?”

“Is the dough pretend round or pretend long?”

(If incorrect responses are given for either question the child is asked again to pretend by imagining in his or her head that the dough that is pretend long. Procedure is repeated until correct responses are given)

“So I’ll put the pretend long dough in the ‘long dough box’.

TEST QUESTION:

“If I had not made the pretend dough long which box would it be in?”

Correct response: “round dough box”

CONTROL QUESTION:

“Which box did James leave his pretend dough in at the beginning of the story?”

Correct response: “round dough box”

Future Hypothetical Test and Control Questions

TEST QUESTION:

“If I pretend to make the pretend dough long which box would it be in?”

Correct response: “long dough box”

CONTROL QUESTION:

“Which box did James leave his pretend dough in at the beginning of the story?”

Correct response: “round dough box”

Pretence-Reality Tracer Group

“Now let’s play this game with James. James knows how to play this game, it is his favourite game. James has some round dough. James is going to tidy up so he puts the round dough in the ‘round dough box’. Now James is going to go to sleep in my bag.”

(Exit James)

“While James is asleep in my bag let’s take the round dough out of the ‘round dough box’.”

False Belief Test and Control Questions

(Experimenter mimes making dough long)

“Let’s pretend to make the dough long. Is dough pretend long?”

Pretence Control Questions

“Are you pretending with me?”

“Is the dough pretend round or pretend long?”

(If incorrect responses are given for either question the child is asked again to pretend by imagining in his or her head that the dough is pretend long. Procedure is repeated until correct responses are given)

“So I’ll put the pretend long dough in the ‘long dough box’. Now James wakes up and comes back for his dough.”

TEST QUESTION:

“Which box will James look in first for his dough?”

Correct response: “round dough box”

CONTROL QUESTION:

“Which box did James leave his dough in at the beginning of the story?”

Correct response: “round dough box”

Counterfactual Reasoning Test and Control Questions

(Experimenter mimes making the long)

“Let’s pretend to make the dough long. Is the dough pretend long?”

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"So I'll put the pretend dough in the 'long dough box'. Now James wakes up and comes back for his dough."

TEST QUESTION:

"If I had not pretended to make the dough long which box would it be in?"

Correct response: "round dough box"

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"Which box did James leave his dough in at the beginning of the story?"

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